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New aerogeophysical survey targets the South Pole Frontier

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Considerable advancements have been made in recent years in unveiling subglacial geology and crustal architecture in interior East Antarctica using airborne geophysics (e.g. Ferraccioli et al., 2011; Aitken et al., 2014). However, the South Pole area remains one of the largest "poles of ignorance", as very little data have been acquired here since pioneering reconnaissance surveys performed in the 1970's (Drewry, 1983). In the late 1990's a more detailed aerogeophysical corridor was flown by the University of Texas, and provided a first glimpse into subglacial geology inland of the Transantarctic Mountains, in particular over the enigmatic South Pole subglacial basin (Studinger et al., 2006).

The South Pole region is receiving heighted attention within the Antarctic geosciences community in light of US-led plans to drill in the region to try and recover > 1.2 Ma old ice and also retrieve bedrock samples to help constrain the subglacial geology of the composite East Antarctic craton.

During the 2015-2016 Antarctic campaign a major aerogeophysical survey comprising new radio echo sounding, laser altimetry, airborne gravity and aeromagnetic data collection was flown over the South Pole as part of our PolarGAP project, supported by the European Space Agency. The main aim of the survey was to provide key missing airborne gravity data required to fill in the void in GOCE (Gravity Field and Steady-State Ocean Circulation Explorer) satellite gravity coverage south of 83.3°S.

Here we present the first results from this survey, including preliminary ice thickness, bedrock topography, and gravity and magnetic anomaly images for the region. We focus on some of the major geological issues that the new data will help address, such as: 1) what is the extent and origin of the Pensacola/Pole subglacial basins that lie in the hinterland of the Ellsworth/Whitmore and Transantarctic Mountains?; are these basins simply the result of Cenozoic lithospheric flexure linked to the uplift of the adjacent ranges along the flank of the West Antarctic Rift System?; or are these basins also controlled by major tectonic features related e.g. to an inland continuation of Jurassic rift basins of the Weddell Sea Rift System and major Jurassic strike-fault systems that flank the Ellsworth crustal block (Jordan et al., 2013)?; 2) is there evidence for the continuation of the Paleo to Mesoproterozoic South Pole igneous province interpreted from satellite magnetic imaging and neighbouring AGAP aerogeophysical data (Ferraccioli et al., 2011)?; 3) are there major fault-controlled subglacial sedimentary basins?; and, if these exist, are these a primary geological control for widespread enhanced ice sheet flow (Bingham et al., 2007) over the South Pole frontier?

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