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Analysing aeromagnetic, airborne gravity and radar data to unveil variable basal boundary conditions for the East Antarctic Ice Sheet in the Wilkes Subglacial Basin

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The Wilkes Subglacial Basin (WSB) extends for ca 1,400 km from George V Land into the interior of East Antarctica and hosts several major glaciers that drain a large sector of the East Antarctic Ice Sheet (EAIS). The region is of major significance for assessing the long-term stability of the EAIS, as it lies well below sea level and its bedrock deepens inland. This makes it potentially more prone to marine ice sheet instability, much like areas of the West Antarctic Ice Sheet (WAIS) that are presently experiencing significant mass loss. This sector of the EAIS has also become a focus of current research within IODP Leg 318 that aims to better comprehend the initial stages of glaciation and the history and stability of the EAIS since the Eocene-Oligocene boundary. Understanding geological boundary conditions onshore is important to assess their influence on ice sheet dynamics and long-term stability and interpret the paleo-ice sheet record. Early geophysical models inferred the existence of a major extensional sedimentary basin beneath the WSB. This could in principle be similar to some areas of the WAIS, where subglacial sediments deposited within rift basins or forming thin marine sedimentary drapes have been inferred to exert a key influence on both the onset and maintenance of fast-glacial flow. However, later geophysical models indicated that the WSB contains little or no sediment, is not rift-related, and formed in response to Cenozoic flexural uplift of the Transantarctic Mountains (TAM). A major joint Italian-UK aerogeophysical exploration campaign over parts of the WSB is super-seeding all these earlier geophysical views of the basin (Ferraccioli et al., 2009, Tectonophysics). Precambrian and Paleozoic basement faults can now be recognised as exerting fundamental controls on the location of both the topographic margins of the basin and it sub-basins; ii) the crust underlying the basin is thinner compared to the TAM (Jordan et al., 2013, Tectonophysics), but is unlikely to be strongly affected by Cretaceous or Cenozoic-age rifting, in contrast to the WAIS, which is largely underlain by the West Antarctic Rift System; iii) its bedrock is composed of rocks of different ages and composition, including Proterozoic basement, Neoproterozoic and Cambrian sediments intruded by Cambrian arc rocks, and cover rocks formed primarily by Beacon sediments intruded by Jurassic Ferrar sills (e.g. Cook et al., 2013 Nature Geoscience). Within the framework of the collaborative Italian-US-UK BABOC project a new international initiative has been launched to analyse and model variable geological boundary conditions in the WSB using geophysical data. A large amount of new ICECAP aerogeophysical observations have been acquired over four campaigns over the region since the International Polar Year, in particular over the southern part of the basin, and some profiles over the northern coastal margin of the basin. We will present an initial interpretation of the potential field signatures and radar data over the northern and central parts of the basin to help establish tectonic and lithological controls on the subglacial topography and different EAIS flow regimes within the WSB.