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A new interpretation from geophysical data of the crustal architecture of the East Antarctic craton between Vostok Lake and Adventure Subglacial depression

Paola Cianfarra and Francesco Salvini
Università Roma Tre, Dip. Scienze Geologiche, Roma, Italy (salvini@uniroma3.it)

Numerical modelling of the Earth surface has been extensively used to investigate regional tectonic settings. The East Antarctic Craton (EAC) is a fragment of the Gondwanaland Precambrian shield as confirmed from the sea floor geophysical reconstruction. Despite the progress achieved in the last decades for the understanding of the tectonic evolution of the EAC, our knowledge of the subglacial geology derives from sparse rocks outcrop around the perimeter of the continent since the ice sheet prevents from direct investigations. Since the onset of the East Antactic Ice Sheet (EAIS), the tectonic activity represents the major modelling agent of the subglacial landscape, due to the mostly dry ice cap-bedrock contact preventing any significant erosional or sedimentary episode. Compressional, extensional, transcurrent tectonic styles of deformation produce characteristic morphological signatures. These landscapes were replicated by a series of numerical Hybrid Cellular Automata (HCA) models. The comparison and tuning of these models with the bedrock morphology allowed to constrain the extensional tectonic style responsible for the formation of the subglacial depressions in the huge region between Vostok and Adventure. Results from the numerical modelling suggest the tectonic origin of the Aurora depression, of the Concordia Trough and of the Adventure Subglacial basin. Crustal listric faults with normal displacements of the order of hundreds to thousands of meters created the necessary space beneath the ice cap to develop the present day subglacial morphologies as derived from RES data and their characteristic geophysical signatures. An original and alternative origin is proposed for the Lake Vostok depression based on the re-interpretation of published geophysical data. The integration of the results allows us to speculate on the existence of an intraplate transtensional deformation belt within the EAC since Cenozoic times.