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0.0.1 3D reconstruction of faults controlling subglacial morphology in the East Antarctica craton: insights from the Vostok-Dome C region

P. Cianfarra (1), C. Bianchi (2), A. Forieri (3), F. Salvini (1), I.E. Tabacco (3)
(1) Dip. Scienze Geologiche, Università Roma Tre, Roma, Italy, (2) INGV, Roma, Italy, (3) Dip. Scienze della Terra, Università di Milano, Milano, Italy

The extensive ice sheet cover in the East Antarctica interior precludes a detailed knowledge of its bedrock physiography. Available geophysical data allowed to identify a series of regional, elongated depressions in the Dome C-Vostok region. The Vostok Lake and the Aurora and Concordia trenches are by far the major depressions in this region. Their length exceeds 100 km and the width is more than 20 km. Several models have been proposed to explain the presence of these intriguing features within the East Antarctica craton ranging from a tectonic origin to a glacial erosional one. Debate is still open on the age of such depressions with a series of hypothesis ranging from Early Paleozoic to Cenozoic times. Radio echo sounding data collected in the last decade within the Italian Antarctic Program PNRA (Programma Nazionale Ricerche in Antartide) allowed to further improve the detailed morphology of these subglacial features. Across strike radar tracks showed the asymmetric profile of these depressions with an eastern steeper slope, and a gentler and smoother western slope. Both the Aurora and Concordia Trench longitudinal profile show the presence of a saddle in the central part that rises up to 200-300 m above their mean elevation resulting in the valley floors deepening both northward and southward. Both these across and along strike morphologies are typically associated with the activity of normal faults. We used the hybrid cellular automata modelling numerical technique (HCA) to test the applicability of the extensional faulting hypothesis, by simulating the 3D geometry of these regionally sized faults. Among the collected data a set of closely spaced, across strike radar track were selected to reconstruct the 3-D geometry of the subglacial morphologies. The optimal orientation of each profile was achieved by pro-

jecting the radar data along an across the average strike of the subglacial depressions. Topographic profiles obtained from the radar data were forward modelled by the HCA technique in a trail-and-error fashion. Cross sectional fault shape and displacements were tuned until the misfits between the present day morphologies and the synthetically generated profiles were minimised. Eventually the whole numerical data set was gridded by a properly oriented asymmetric interpolation to reproduce the overall 3D geometry of the regional extensional fault system bounding Concordia and Aurora Trenches, and of the predicted subglacial morphology. Comparison between the radar longitudinal profiles of the valleys and the synthetically generated surfaces showed a good correlation of the two data set confirming the existence of the tectonic activity in the Vostok-Dome C area.