Geophysical Research Abstracts,
Vol. 11, EGU2009-8569, 2009
EGU General Assembly 2009

Modelling the tectonic origin of the Adventure Subglacial Trench, East Antartica

P. Cianfarra (1), A. Forieri (2), and F. Salvini (1)

(1) Università Roma Tre, Roma, Italy, Dip. Scienze Geologiche, Roma, Italy (cianfarr@uniroma3.it), (2) Istituto Nazionale di Geofisica e Vulcanologia, INGV

In the last decades progress occurred in the knowledge of the geological setting of the buried bedrock in East Antarctica. Yet to date, lots of questions still remain unanswered as the crustal architecture and tectonic evolution of some sectors of the Antarctic craton.

The Adventure Subglacial Trench was firstly detected in the ‘70s by reconnaissance airborne radio echo-sounding. It is a NNW-SSE trending subglacial trough buried beneath over than 4 km of ice, about 50 km wide, more than 200 km long, and 750-1000 m deep, lying along the western flank of the Wilkes basin. The Resolution Highlands and the Belgica Highlands bound the Adventure Trench to the E and to the W respectively.

Although the tectonic origin of the Adventure Trench is widely accepted, being the elongated trough associated and parallel to a regional scale alignment of magnetic and gravimetric anomaly, debate is still open on the tectonic style that brought to the development of this depression. From early geophysical investigation a rifted crust with sedimentary infill of about 3 km was inferred beneath the Adventure Trench. Ferraccioli et al. (2001) based on gravity modelling interpreted the Adventure Trench as a narrow rift basin with about 25 km thick crust and a huge sedimentary infill of about 10 km. On the other hand, Studinger et al (2004) proposed a compressional scenario for the origin of this depression.

A cluster of subglacial lakes have been identified along the axis of the Adventure Trench from radio echo soundings. Wingham et al. (2006) interpreted ice sheet surface elevation changes as the result of huge water discharge from the lakes. Hence an improved understanding of the geologic history of the investigated area is required to infer hypothesis on the distribution and evolution of subglacial water.

An extensive geophysical campaign was flown over East Antarctica from the Transantarctic Mountais to Dome C during the 2003 Italian Antarctic field season. Radio echo-sounding (RES) data were collected along transects roughly parallel to the 75°S and 76°S parallels and allowed to identify the main bedrock physiographic features, including the Adventure Trench.

RES data showed the asymmetric transversal profile of the Adventure Trench characterised by an eastern steepest slope that contrast with the gently rounded shape of the western slope. This morphology resembles the half graben geometry typically resulting from the activity of listric faults. Similar transversal profiles characterise also the Concordia and Aurora trenches in the Dome C region that have been interpreted as the result of the activity of listric normal fault of crustal importance.

In this work a tectonic numerical modelling of the bedrock morphology of the Adventure Trench was performed to explore its possible extensional tectonic origin. The forward modelling by HCA technique consisted in simulating the observed morphology by fault activity. Several tectonic scenarios have been tested including compressional and extensional faulting. The best fit between the real morphology and the model was achieved by listric normal faults, whose hangingwall shape closely replicates the observed bedrock topography.