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Inferring the tectonic setting of the Gamburtsev Subglacial Mts by ice cap surface lineaments

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Gamburtsev Subglacial Mts (GSM) are by far one of the most puzzling physiographic feature of the East Antactic craton. Located at the centre of the Antarctic continent and beneath the highest point of East Antarctic Ice Sheet (Dome A) they were discovered during the 1957-58 International Geophysical Year by a Soviet expedition using seismic instruments to measure the thickness of the ice sheet.
This intracratonic mountain range is characterised by peaks with elevation exceeding 3500 m and covers an area bigger than the European Alps.
The GSM were the target of a huge international geophysical expedition during the 2008-2009 summer season with the aim of revealing the geologic nature and origin of this mountain range, as well as to further understand the tectonic setting of two of the largest Antarctic subglacial lakes bounding to the East and to the West the GSM, namely the Vostok and Recovery lakes.
Preliminary results of this international scientific campaign have been presented to the scientific community and showed that the GSM are characterised by a typical alpine landscape with a rectangular hydrographic network. These morphological features are commonly associated to recent/active tectonics.
At present, four scenarios exists to explain the existence of such intracratonic mountain range: (i) a hot-spot beneath the Antarctic crust, in a Hoggar-like mantle plume scenario; (ii) a continental collision (of unknown age) similarly to the Alpine orogenic belt; (iii) a rifting process associated to flexural uplift or isostatic rebound of the rift shoulder, in a Transantarctic Mts like scenario or similarly to the mountains along the edges of the East African rift lakes; and (iv) a continental arching related to regional, continental-scale stress like the Black Hills in the North America continent or the russian platform arching located NE of Moscow.
These geodynamic scenarios are characterised by different morpho-tectonic signatures that can be successfully investigated by lineament analysis to contribute in solving the puzzle related to the GSM existence.
Regionally sized swarm of lineament cluster exists on the earth surface and are related to the recently active crustal stress field. Specifically the main lineament domain trend parallel to the maximum horizontal crustal stress. These lineaments are present even on the surface of the EAIS and relate to the buried tectonic structures.
In this work we compare the automatically detected ice sheet surface lineament pattern with lineament analysis from the Hoggar Massif, the Alpine orogenic belt, the mountain bounding the East African rift lakes and the Black Hill. Results allow to evaluate the reliability of the proposed models for the origin of the GSM.