Unmapped Geologic Macrostructures identified with GOCE

Carla Braitenberg
University of Trieste, Department of Mathematics and Geosciences, Via Weiss 1, 34128 Trieste, Italy
berg@units.it

The observations of the satellite GOCE have allowed to achieve a qualitative leap ahead in the spectrum of applications feasible with gravity data. The new global field has an improved resolution of 80km and precision of 1mGal; this resolution is sufficient to study the crustal thickness variations and the upper crustal structure. Geological macrostructures accompanied by density variations can be mapped for the first time by a global satellite field in continental areas, which opens a new series of applications in geophysical exploration. We consider an area where terrestrial observations are scarce due to difficult terrain, making the new GOCE-derived field the best gravity field today available. This area is located to the north of the Congo craton, and straddles the countries of Cameroon, Central African Republic, Sudan, South Sudan, Gabon, Democratic Republic of Congo and Congo. The area is of general interest, as it is in a key position of the continent Gondwana, from which the South American and African continents were formed. The Congo craton is an old crustal nucleus with a deep lithospheric root, which constitutes an indeformable unit, against which the surrounding crustal units are defomed. We use the GOCE satellite to unscramble these deformations, which cover 2 Ga years of Earth history, and have produced important mineral deposits as gold, platinum and iron. We first show that the GOCE observations perfecetly correlate to known geologic units. We then demonstrate that GOCE allows to differentiate the geologic structures, identifying the margins of the high density units formed by metamorphic addensations of rocks, discriminating between different geologic units. The results have direct applicability in mineral exploration and show that the GOCE observations constitute an innovative tool of mineral exploration in remote areas.