IDENTIFYING MACRO-GEOLOGICAL STRUCTURES USEFUL FOR MINERAL EXPLORATION WITH GOCE

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GOCE
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Aim of Study

• Map **cross-continental macro-geologic** lineaments using the GOCE gravity field.

• Identification of geologic lineaments is a basic piece of knowledge in mineral exploration and targets new geologic/geophysical mapping

• **Cross-continental lineaments**: features that formed previous to continent-break up
Contents

• 1) GOCE data reduction and identification of macro-geologic lineaments.
• 2) Central Africa mineral findings and geologic units
• 3) Cross-continent lineaments: reconstructed gravity of Gondwana
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Geologic residual gravity field

• Observed GOCE gravity and gradient must be reduced by obvious signals:
  • Greatest contributions are: Topography (-10km to +10km), crustal thickness (70km to 1 km)
  • Next important: sedimentary basins
  • Global Residual: isostatic flexure or regression analysis gravity and topography.
Gravity residual calculation
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Example Central Africa

Bouguer reduced by isostatic Moho and sediments

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Macro-geological structures with GOCE
Productive lineaments

Geological Map

GOCE Bouguer map

Bouger reduced by isostatic Moho and sediments

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**Geological Map**

**GOCE Bouguer map**

Bouguer reduced by isostatic Moho and sediments

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Macro-geological structures with GOCE
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Cross-Continent Lineaments

• Macro-geologic units partly have formed before continents separated
• Therefore cross-continent continuity is expected for units that formed before continent-separation
• GOCE gravity field is used hypothesizing rigid continents rotations
• Gondwana reconstruction: Earth at 255 Ma
Gravity of Gondwana

GOCE Residual Free Air at 255Ma

Zoom on Africa-South America

GOCE Residual Free Air at 255Ma
Conclusions 1/2

• For the first time a global gravity field can resolve geologic structures. Wide range of applications:
  • No loss of continuity across boundaries: national, continent-ocean boundary, high elevations
  • Close coastal gap between satellite-altimetry and terrestrial field
  • Excellent match of gravity and known geologic units (Alps, Himalaya, Africa)
Conclusions 2/2

• Allows global continent reconstructions
• Geologic mapping of potentially productive rock units successful
• New tool for exploration of natural resources
Thank you for your attention!

Bora a Trieste, Febbraio 2012