DK-Proposal 28

Submitted by
Peter Japsen pj@geus.dk
GEUS
Øster Voldgade 10
DK-1350 Copenhagen K, Denmark

Vision of an integrated geoscientific project in the IPY 2007-2008.
Ice sheet stability and mountain building in Greenland

Disciplines:
Glaciology, geology, geomorphology, gephysics, sedimentology, climatology

Research:
Numerical simulations of the development of the Inland Ice indicate that the existence of coastal mountains surrounding the interior of Greenland is decisive for the initial stage of build-up. The model simulations show that ice sheet build-up begins as local glaciations in the coastal mountains, that eventually spread out to the interior regions as a result of the fact that increased surface elevation creates climate conditions favouring further glacier build-up. However, several recent studies indicate that kilometre-scale uplift affected both West and East Greenland in the most recent geological past – either prior to the onset or simultaneously with the late Cenozoic glaciations. In fact, central West Greenland may have been low-lying prior to 10 million years ago according to preliminary interpretation of apatite fission track analysis data and large scale landforms undertaken as part of an ongoing research project. If this were so, the lack of such mountains would be a major constraint on ice-sheet development models and on climate models at the start of the ice ages. Associated vertical movements of the sea floor must have led to changes of sea currents and thus to the oceanic heat exchange between the tropical and arctic Atlantic. We propose to investigate the timing of the uplift of the coastal regions of Greenland during the late Cenozoic and to analyse how different scenarios could have affected the generation of the Inland Ice. The outcome of the investigations may also have far-reaching influence on our understanding the Earth's climate during the late Cenozoic. Initially, this work would involve researchers from many branches of geoscience: glaciology, geomorphology, oceanography, geophysics, structural geology, climatology, sedimentology, biostratigraphy etc. A variety of methods need to be used to investigate uplift, erosion and redeposition: Studies of maximum burial, fission tracks, geomorphology, sediment supply and structural relations. Each method on its own investigates only one aspect of the phenomenon, and a thorough understanding of the processes of uplift and erosion can be achieved only if results from all these methods are integrated.

Models of the evolution of the Inland Ice should be tested for different geological scenarios.

The study group should eventually include modellers of climate and oceanography.

Proponents:
Peter Japsen1, James A. Chalmers1, Jeroen van Gool1, Niels Reeh2
1Geological Survey of Denmark and Greenland (GEUS), 2ARTEK, BYG·DTU

Partners:
The Euromargin project (supported by the ESF but with no funding for Danish participants, investigates the geological development of East Greenland),

Jan Inge Faleide, Olav Eldholm, Ebbe Hartz, Ole Humlum, Universitet I Oslo,
Karna Lidmar-Bergström, Stockholm University,
Paul F. Green, Geotrack International, Melbourne,
Philippe Huybrechts, Alfred-Wegener-Institut für Polar- und Meererforschung, Bremerhaven
Sierd Cloetingh, Paul Andriessen, Vrieje Universiteit, Amsterdam,