

The Greenland Analogue Project (GAP)

by

Jon Engström¹, Anne Lehtinen², Timo Ruskeeniemi¹ and Lillemor Claesson Liljedahl³

¹*Geological Survey of Finland, P.O. Box 96, FI-02151 Espoo, Finland*

E-mail: jon.engstrom@gtk.fi

²*Posiva Oy, Eurajoki, Finland*

³*Svensk Kärnbränslehantering AB, Stockholm, Sweden*

The *Greenland Analogue Project* (GAP) was initiated to understand the effect of glaciations on the thermal and hydrological behavior of crystalline rock during long-term disposal of nuclear waste for hundreds of thousands of years. Glacial conditions with growth of ice sheets and permafrost will likely occur in Fennoscandia and Canada during this time perspective. To advance the understanding of the impact of glacial processes on the long-term performance of a deep geologic repository, the GAP project has been established by the Swedish, Finnish and Canadian nuclear waste management organizations (SKB, Posiva and NWMO).

Using the *Greenland Ice Sheet* (GrIS) as a modern analogue for future continental-scale ice sheets in previously glaciated regions, field and modelling studies of the GrIS and subsurface conditions were undertaken. The GrIS was chosen because it is of about the same size as those ice sheets known to have formed, and expected to form in the future in Fennoscandia, which suggests that the scale of processes and response times could be similar during the glaciation and deglaciation phases. Moreover, the bedrock in the study area is crystalline, with similarities to the crystalline bedrock in Sweden, Finland and Canada in terms of composition, fracturing and age.

The main research aims for the GAP concerns permafrost characteristics and development, groundwater flow and its chemical composition, bedrock stress and rock mechanical characteristics, and an integrated view of ice sheet hydrology. The GAP was divided into three subprojects 1) surface-based ice sheet studies; 2) ice drilling and direct studies of basal conditions; and 3) geosphere studies, each with specific individual objectives but collectively aimed at contributing to the understanding of the research aims listed above. The results and research undertaken as part of the GAP has advanced the scientific understanding of hydrological processes associated with a retreating ice sheet Greenland Ice Sheet (GrIS), including the temporal and spatial nature of processes occurring on the ice sheet surface, conditions at the ice sheet bed (thermal and meltwater generation) and also interactions between glacial meltwater and the underlying groundwater systems.

The project is in the final stages and the final report is schedule to be released during September 2015 in the nuclear waste management organizations reporting series.