Evaporite diapirs in Axel Heiberg Island, Nunavut: gauging their past and present growth rate and their geothermal energy potential

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Diapirs and other salt-cored intrusive structures in the Sverdrup Basin are displaced sedimentary evaporites of the Carboniferous (Upper Mississippian to Middle Pennsylvanian) Otto Fiord Formation. They are spectacularly exposed in the desert-like environment of Axel Heiberg Island, Canadian Arctic Archipelago, as domes and hills made of anhydrite-gypsum (locally with halite) that commonly include rafted blocks of limestone, dolomite and basalt. Field and laboratory work in 2003 and 2004 suggest that some anhydrite bodies had risen, and were exposed at the surface, at a time of active subaerial basaltic volcanism during the Early Cretaceous extensional phase of development of the Sverdrup Basin, although some of the basaltic lava fragments have not all been dated. It is generally known that evaporitic structures moved forcefully during the compressive Eurekan orogeny in the Paleocene-Eocene, a time of active thrust faulting. Our recent field work points to the fact that many of the anhydrite-gypsum structures have risen tens to hundreds of meters from the glaciated valley bottoms in post-glacial times, which could translate in growth rates of 1 to > 5 cm/yr, thus the fastest growing mountains in Canada. This hypothesized rate of growth should be easily detected by In SAR methods, although our preliminary results are disappointing because of the scarcity of suitable radar images. During the next few summers we will perform sequential GPS surveys, and install ultra-sensitive geodesic control stations to measure absolute and differential movements in the region.

Salt is a better conductor of heat than other sedimentary rocks, therefore geothermal heat is funnelled by deeply rooted diapirs. Close to some diapirs, this geothermal heat has melted the (otherwise ~ 600 m thick) permafrost and generated perennial brine springs of constant annual temperature (~ 5°C) irrespective of air temperature (the active springs and remnant examples have been comprehensively studied by the McGill group). We will evaluate the heat exchange capacity of perennial springs in the Expedition Fiord area as a potential source of heat in year-round research stations.

The traditional carving stone for the Inuit is near exhaustion and has to be imported. As an offshoot of the project we are testing the use of alabaster gypsum and anhydrite from diapirs in Axel Heiberg Island as an alternative carving stone in Nunavut.