Geophysical Research Abstracts
Vol. 13, EGU2011-9371, 2011
EGU General Assembly 2011

Reconstructing the sedimentary processes within Pleistocene tunnel valleys from case studies

Paul van der Vegt (1), Philip Gibbard (1), and Andrea Moscariello (2)

(1) Cambridge Quaternary, Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, England, United Kingdom (paulvandervegt@gmail.com), (2) Department of Geotechnology, Delft University of Technology, Stevinweg 1, 2628CN Delft, The Netherlands

Tunnel valleys are large, elongate depressions eroded by sub-glacial meltwater beneath the marginal zones of former ice-sheets. The objective of this poster is to show general sedimentary models for tunnel-valley sediment fills, based on investigations of a several tunnel valleys, chosen for their accessibility and/or borehole evidence availability. These sedimentary models are the first of their kind to be presented. They improve the general understanding of these sub-glacial meltwater systems, as well as being of considerable value for testing the results of ice-sheet models. They can also be applied to support prospecting for economic resources (water and hydrocarbons).

Examples of tunnel valleys of various ages have been reported from almost every continent, from rocks ranging from Pleistocene, Ordovician, Permo-Carboniferous to Neoproterozoic in age. The largest tunnel valleys reach up to 500 m in depth, 5 km in width and extend over a 100 km in length. They are characterised by undulating thalwegs, and abrupt starts and terminations. In North-western Europe and North America Pleistocene examples frequently form highly complex networks of intersecting channels that usually occur in areas of relatively soft and easy erodible substrate. They originate from erosion by sub-glacial meltwater systems through which sediment is transported and ice-sheet dynamics are influenced.

Recent advances in tunnel-valley research achieved using geophysical methods, such as 3D-seismic and transient electromagnetic investigations, have greatly increased the data available and understanding of the spacing and dimensions of the valley forms. Advances have also been achieved through the understanding of sub-glacial processes beneath modern ice sheets by using remote-sensing methods and modelling. In spite of this progress, little is still known about the sedimentary facies and suites deposited within tunnel valleys. Only rarely have cored boreholes been described to date and only a few outcrop investigations have been undertaken in a systematic fashion. Outcrop studies of Pleistocene tunnel valleys have been hampered because their infill is frequently buried beneath younger accumulations. Recent advances in onshore mapping together with the increased availability of borehole information have made study possible.

The research presented is based on detailed Pleistocene tunnel-valley investigations carried out in England, Denmark and Canada. It will be shown that the valley infilling can be very heterogeneous, ranging from sub-glacial diamicton to glaciolacustrine clay and silt and to glaciofluvial gravels and sands. It is hoped that general patterns might emerge, but to date the infillings appear to be specific to individual valley networks. The reconstructed sedimentary environments show that valley infillings can to some extent be characterised by a finite number of models relating to their environment of infilling. This talk will present examples of how tunnel valley infills depend on the ice-sheet dynamics, as well as geographical and climatic influences.