

The role of sub-glacial hydraulic conditions for the formation of fractures in basal tills, examples from recent Icelandic tills and Pleistocene tills in Denmark

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Generally glaciotectionic fractures forms as a result of sub-glacial load and shearing of the subsurface. However sub glacial hydraulic conditions highly affect the formation of fractures in tills. These conditions depends on three major factors; 1; local hydraulic properties of the till (matrix permeability and thickness) 2; Drainage conditions below the till, and 3; the sub-glacial recharge of melt-water (depending on annual melt water recharge cycles, controlled by local climatic conditions).

In order to investigate the formation of fractures under well-known climatic conditions, a number of basal tills was studied in front of Kötlujökull and Slettjökull, Iceland (Klint et al 2010), and compared with the formation of fractures at a significant number of locations in Danish clay tills.

Several types of fractures were forming depending on a number of factors. Generally sub glacial water-saturated areas favour the formation of hydraulic fractures and water-escape structures. In contrast un-saturated conditions favours the formation of sub horizontal shear-fractures and low-to steeply dipping conjugate sets of shear fractures striking perpendicular or parallel to the ice-movement direction.

These observations have formed the background for evaluating fracture distributions in Danish clay tills based on primarily till thickness, till-type, texture and geo-morphology (Klint et al 2013), thus allowing some general assumptions for risk-assessment of groundwater reservoirs covered by till.

References:

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