

## **Glacigenic fault reactivation and enhanced groundwater flow: a previously unrecognized hazard to restoration of abandoned mine sites**

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Glacitectonic reactivated bedrock faults and joints are common features encountered in open pit and underground mine workings in glaciated regions. Enhanced permeability leading to flooding and other ground control problems are associated with these fracture systems, which often act as high flow conduits for groundwater flow. As such, glacigenic fractures can be instrumental in the production and transport of acid mine waste, but are rarely considered in site restoration programs.

A detailed study of glacigenic fractures undertaken at the Stratmat and ACD zones at Heath Steele Mines, New Brunswick demonstrated the potential hazards associated with glacigenic fractures. During that study an encounter with groundwater flow in excess of 800 litres per minute, along a re-activated fault intersected by a tunnel thirty metres below ground, resulted in extensive flooding during the fall of 1992. For a period of one month, groundwater flow from this

fracture system continued, due to re-opened jogs along a fault plane that provided connections to ground surface. Other conduits (possibly with fewer interconnections) were identified at depths 100 metres below ground, yielding groundwater flow of the order 10-30 litres per minute. The results indicated that flow along fractures was channelized and the quantity of discharge variable, due to the degree of fracture-interconnection.

Glacigenic fracture zones, causing enhanced permeability and contaminant migration, can be identified during field studies and from borehole data using several criteria, including: the presence of glacial sand and gravel in open fractures, RQD values, and losses of drill fluid during drilling. Data from such studies are essential in delineating contaminant transport at mine sites and should be addressed in every mine site reclamation plan.