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FOLD-RELATED FRACTURES AND POSTFOLDING FRACTURING, ROCK MASS CONDITION ANALYSES AND GEOLOGICAL MODELLING IN TURTLE MOUNTAIN (Alberta Canada).

Florian Humair (1), Jean-Luc Epard (2), Michel Jaboyedoff (1), Andrea Pedrazzini (1), and Corey Froese (3)
(1) University of Lausanne, Institute of geomatics and risk analysis, Lausanne, Switzerland (florian.humair@unil.ch), (2) University of Lausanne, Institute of geology and paleontology, Lausanne, Switzerland , (3) Alberta Geological Survey

Turtle Mountain is located in the Foothills in southwest Alberta and is formed by highly fractured Paleozoic carbonates rocks and Mesozoic clastic rocks. This area is mainly affected by two major geological structures that are the Turtle Mountain anticline and the Turtle Mountain thrust. This site has become famous after a 30 M m3 rock avalanche of massive limestone and dolostone affecting the eastern mountainside of Turtle Mountain on April 1903. This resulted in more than 70 casualties and buried part of the Frank village.

A detailed analysis of predisposing factors leading to failure has been performed using a structural and rock mass condition field analysis (geological and geotechnical mapping, rock mass classification, Schmidt hammer). In addition remote sensing analyses have been provided (High Resolution Digital Elevation Model, Coltop 3D software).

The local variations of discontinuity sets and rock mass conditions has been estimated in order to separate the study zone into homogenous structural domains and to correlate them with unstable areas (volumes and failure mechanisms).

The aim of this study is to build a theoretical model that shows the relationship between the anticline geometry and the fracturating density. It should be able to determine the origin and the chronology of the discontinuity sets in relation to the tectonic phases (mainly the folding one).

A 3D geological model based on several geological profiles performed perpendicular to the Turtle Mountain anticline is necessary to make a detailed analysis.

The preliminary results indicate the role of discontinuity sets in the failure mechanisms of the mountain. Moreover if some sets only appear in one limb of the anticline, some others are present in both limbs indicating their posteriority compared with the first ones.
Furthermore, a relation between the distance to the fold axis and the quality of the rock mass (Geological Strength Index) has been statistically pointed out, illustrating the influence of the high fracturing density of the hinge area on the weathering of the mountain. In fact, we can easily expect in carbonate rocks, that the denser the fracturing is, the stronger the chemical weathering occur. Consequently the GSI values are smaller in the hinge area than in the outer zones. The GSI values are interpolated using Cokrieging producing a map that shows this relation.