LANDSLIDES NEAR FORT ST. JOHN, BRITISH COLUMBIA

Jordan Severin, Dept of Earth and Ocean Sciences, UBC, Vancouver, Canada
Oldrich Hungr, Dept of Earth and Ocean Sciences, UBC, Vancouver, Canada
S.G. Evans, Geological Survey of Canada, Ottawa, Canada
John Clague, Department of Earth Sciences, Simon Fraser University, Vancouver, Canada

The Peace River Area of northeastern British Columbia and northwestern Alberta is one of the most important oil and gas production districts in Canada. The vast amount of hydrocarbon extraction has created an extensive system of pipelines and roads that crisscross the unstable riverbanks of the region. A better understanding of landslides in the region, type, activity, and failure mechanisms, will be beneficial to the management of the regional infrastructure.

Many large, deep-seated landslides have occurred within the Peace River Valley and its steep-sided tributary valleys. These failures mostly occur within the Lower Cretaceous Shaftesbury Formation, horizontally bedded marine shale, and in the interglacial silt and clay beds within the Quaternary sequence. Smaller failures are seated completely within the youngest glacial Lake Peace clay beds.

This article describes an ongoing research project, aimed at compiling an inventory of deep-seated landslides in the Fort St.John area, using airphoto interpretation and engineering-geological field mapping. The study area is NTS Map Sheet 94A (Charlie Lake), comprising 14,000 km^2 of terrain. Practically all slope activity in the study area occurs on slopes of stream valleys. Therefore, the inventory has a somewhat linear rather than areal framework. The study attempts to separate the observed landslides, approximately 1,400, into a series of failure types, involving bedrock, Quaternary deposits or both. The main focus of the typological classification is the failure mechanism. The classification is being reinforced by more detailed field study of selected type cases.

Of those slope movements where the movement mechanism can be positively identified, 30% are single rotational failures, 27.5% are shallower failures either with a high translational component or that are rotational failures that have retrogressed to a maximum limit, 3% are multi-level successive failures utilizing weak surfaces at multiple levels, 5% are well defined multiple rotational failures, 12.5% are steep cliffs with debris at the base (no mechanism inferred), 2% are earth flows or mudflows, and 2% are shallow glacial Lake Peace failures. One interesting characteristic of the local slope movements is that in approximately 15% of the cases the precise slide mechanism cannot be determined without subsurface investigation. These landslides could be either successive failures, or multiple-retrogressive rotational failures. This dilemma of failure mechanism occurs extensively both in the Quaternary and the Cretaceous.

An activity classification was implemented based on field observations and dated air photographs. The classification includes landslides that are very active (< 5 years), active (< 50 years), of low activity (< 500 years), ancient (> 500 years), and anthropogenically modified. Preliminary results indicate that approximately 85% of the total lengths of valley slopes in the study area, roughly 1070 km, are involved in mass movements. Of the 1370 landslides currently identified, very active or active landslides constitute approximately 16%, 60% are of low activity, 22% are ancient, and 2% are modified. The estimated areas of individual slide units range up to approximately 100,000 m^2 and volumes to 10,000,000 m^3.

The result of the inventory will be a landslide map at a 1:20,000 scale, a database of landslide characteristics, including activity and more detailed descriptions of type cases. A review of the Quaternary stratigraphy of the study area is being conducted in parallel.