Forest Sciences

Prince Rupert Forest Region

Extension Note # 46
March, 2002

Catastrophic Rock Avalanche: Howson Range,Telkwa Pass

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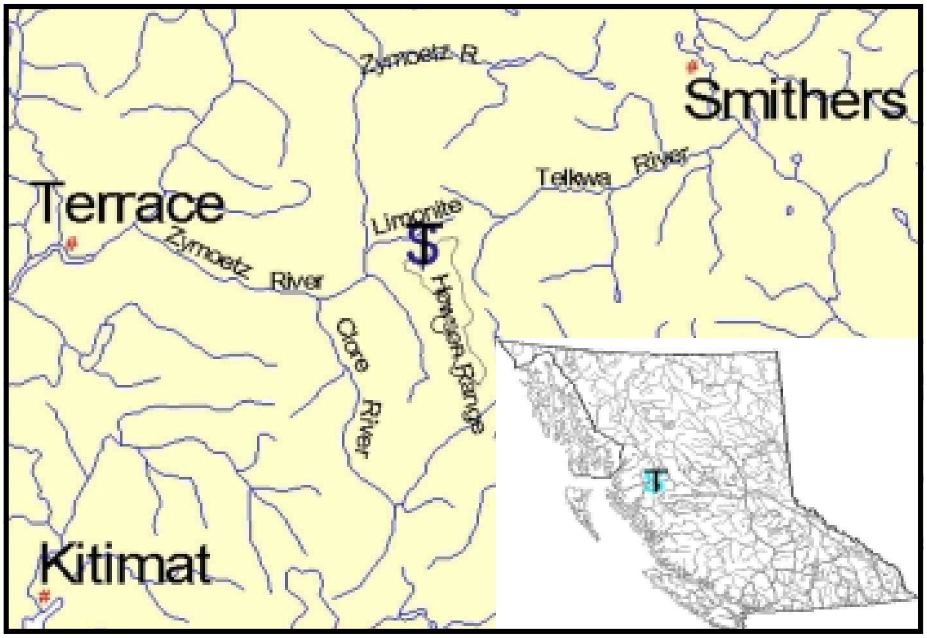

Figure 1. Location of rock avalanche in Howson Range.

Introduction

At 03:00 hours on Saturday Sept. 11, 1999, a large rock avalanche severed Pacific Northern Gas pipeline through the Telkwa Pass, 50 km west of Smithers and a like distance east of Terrace, B.C. (Figure 1).

Physical Setting

A series of ice-valley glaciers extend northward from FUBAR Glacier in the Howson Range into Limonite Creek valley. Considerable glacial ice loss has occurred over the past 50 to 150 years within the ice valleys, exposing oversteepened valley walls (Figure 2). The ridges between the glaciers extend up to 300 meters in height and are composed of highly fractured and near vertically jointed granodiorite bedrock. Rockcliffs also rise up directly above Limonite valley in the Telkwa Pass area. Rockfalls in the vicinity can often be heard tumbling onto glacier ice or down slopes.

Landslide Description

The rock avalanche originated as a topple failure of about 900,000 m^3 from a bedrock ridge. The rock toppled and slid about 150 meters onto glacial ice, expanded to cover the ice-valley glacier to a width of 300-400 meters, continued down the ice valley then avalanched into the Limonite Creek valley (Figures 3, 4, and 5). The rock avalanche travelled a distance of 2.7 km, dropping 1,300 meters in elevation. The avalanche path through mature forest covered an area 1,200 meters long and up to 400 meters wide (Figure 6).

Figure 2. Ice valley glaciers, Howson Range-Telkwa Pass.

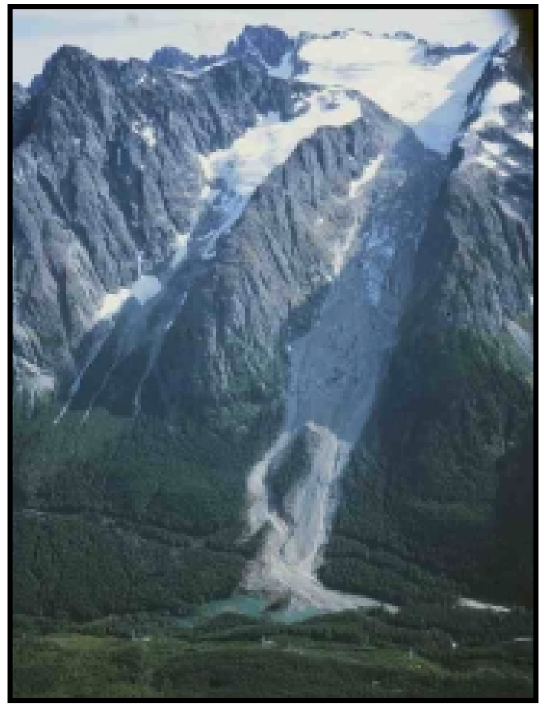

Figure 3. September 1999 rock avalanche. Note location of rock topple-slide, Ice valley glacier, rock avalanche path, deposition zone, and new lakes.

Figure 4. View up ice valley toward the headscarp. Note the headscarp, rock topple/slide on to glacial ice and near vertical joints in granodiorite bedrock (red arrows).

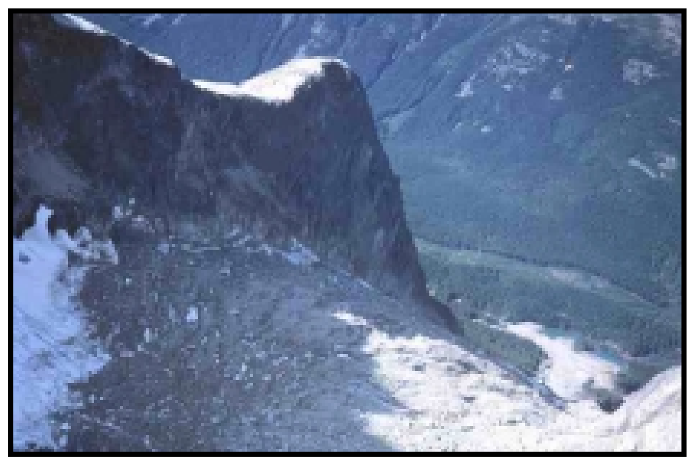

Figure 5. Ice valley drop into Limonite Creek valley. Note the path of travel of the rock avalanche, and new lakes at the bottom of the slope.

Scour along the avalanche path through the forest, incorporated colluvial and morainal material. Trees were blown over by the air blast along the sides and front margin. Mud was splattered on vegetation beyond the edge of the slide. Landslide debris dammed Limonite Creek, creating a lake that filled within a few days. The avalanche was contained along the west and east boundary, below the ice-valley glacier, by lateral moraines and a gully. Flow features appear in the depositional zone issuing from the gully along the east boundary of the avalanche—these flow features could indicate that a large debris flow, from the gully, occurred after the initial avalanche (Figure 7). The gully had probably been filled with landslide debris. Despite the large forest area contained in the avalanche path, few trees are visible in the landslide debris. Large boulders, some the size of a small house, are strewn along the landslide path (Figure 8). The avalanche incorporated and transported a total volume in the order of 2 to 5 M m^3.

Figure 6. View toward the ice valley. Note rock avalanche width, forest removed, and gully on the left of photograph.

Figure 7. View up Limonite Creek. Note depth of valley in fill creating a dam, flow features from gully contained within landslide debris.

Figure 8. Helicopter situated next to a house-sized boulder carried down in the avalanche.

Rock toppled onto a slope with a gradient of 60 to 80 degrees, and slid onto glacial ice at a slope of about 10 degrees. The rubble hurtled over the ice along an ever-increasing slope gradient, dropping into the valley over a slope of close to 40 degrees. Travel through the forest was along a slope gradient of 25 degrees. Deposition occurred on slopes of less than 10 degrees. Average slope gradient from the top of the headscarp to the end of the deposition zone is 27 degrees.

Climatic Conditions Prior to the Event

A chart of precipitation and temperature for the Terrace airport is presented in Figure 9. Rainfall, during the months of May to August 1999 was reported at 2 times normal for the Terrace airport. Temperature for the summer of 1999 was below normal with conditions relatively clear and cool at the time of the event. However, daily mean temperatures for June, July and August 1998 were 3.2, 3.5 and 2.1 degrees above normal, respectively.

Contributing Factors

The steeply jointed and fractured bedrock on near vertical slopes is a contributing factor to slope failure. Above normal precipitation could have been the trigger. Over recent years, the thinning and recession of the Howson ice-valley glaciers has contributed to the debutressing and hence the destabilization of the near vertical rock slopes. Evans and Clague (1994) suggest recent melting of mountain glaciers as an important process in debuttressing of rock slopes adjacent to glacier surfaces.

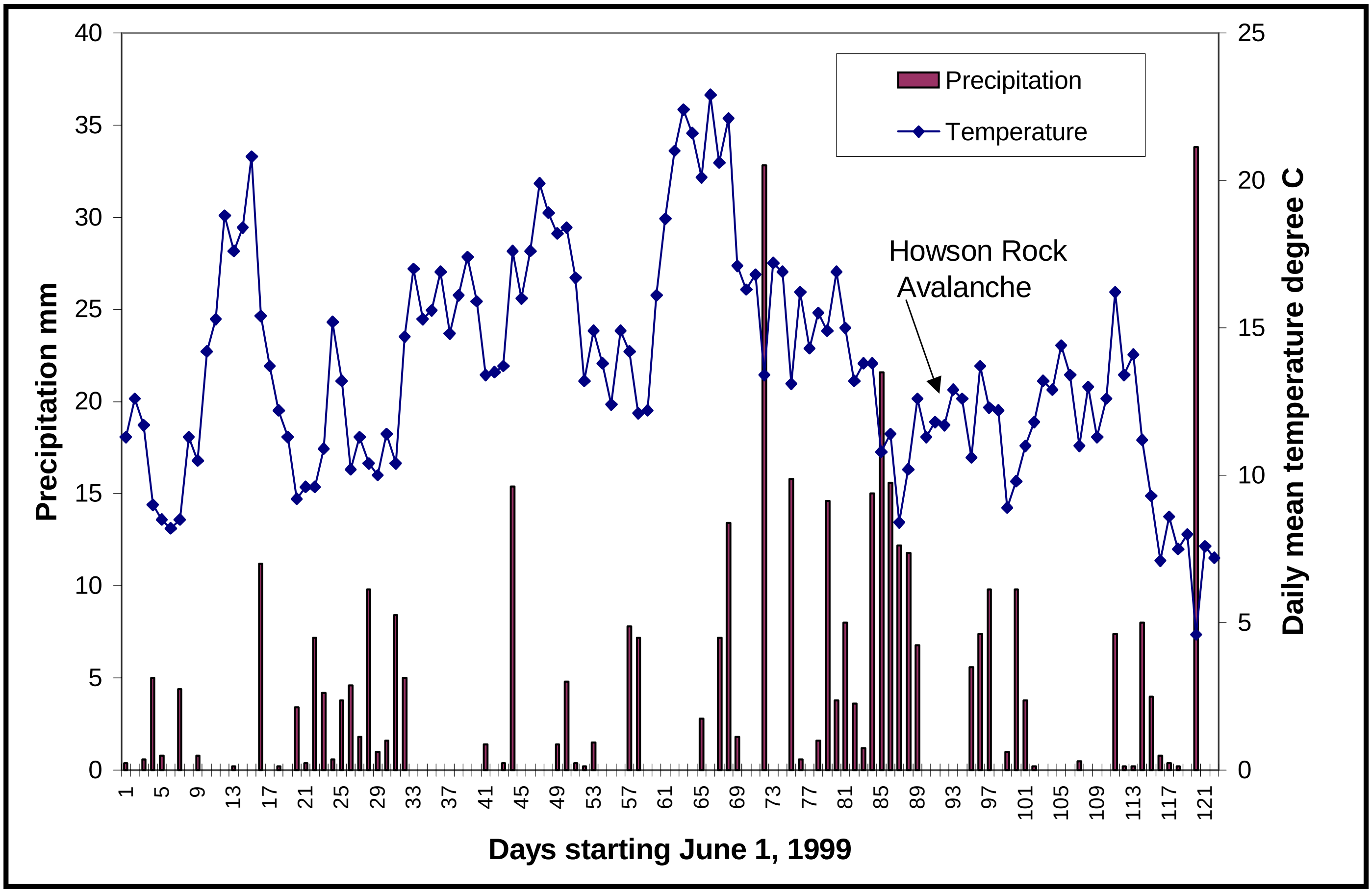

Figure 9. Precipitation and temperature June-September 1999, Terrace Airport.

History of Rock Avalanches

The September 1999 Howson rock avalanche is one of a number of rock avalanches that have occurred recently in British Columbia. Goat Mountain rock avalanche occurred in July of 1999, 45 km NW of the town of McBride on Kendall Glacier (pers comm. M. Geertsema). In the spring of 1997, a 4-10 M m^3 rock avalanche occurred from the southern flank of Mount Munday in the Waddington Range (Evans and Clague, 1998). These rock avalanches involved rock failures from slopes adjacent to glaciers, with debris travelling a considerable distance over glacial ice

Rock avalanches similar to the September 1999 event may have occurred in the Howson Range in the past. Lakes within Telkwa Pass were created by landslide dams. Also, large boulders located near the confluence of Limonite Creek and Zymoetz River may have originated from rock avalanches in Howson Range. The presence of highly unstable, unsupported rock ridges (Figure 10) and the geomorphic evidence of past landslides suggest that the potential for other large rock avalanches exist.

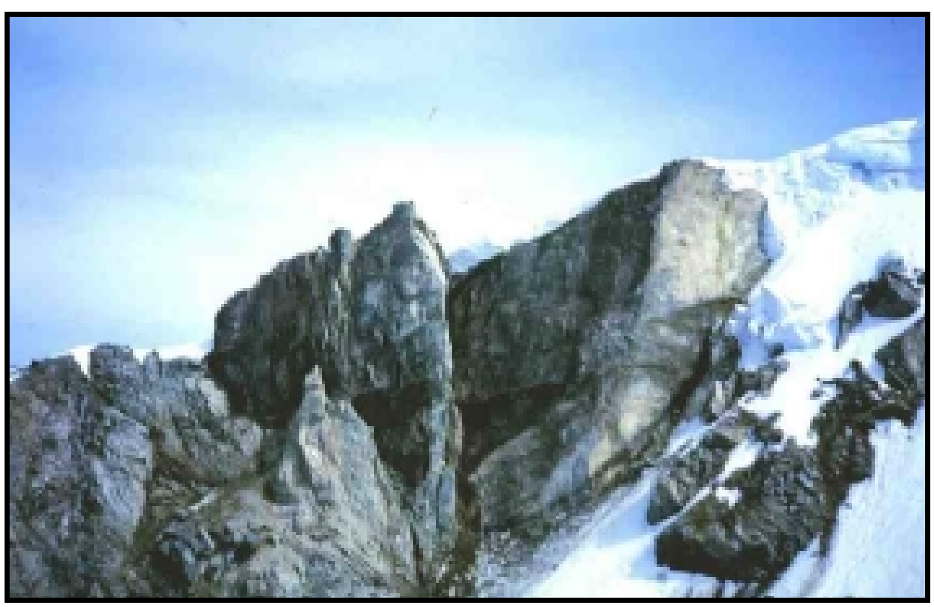

Figure 10. Highly unstable unsupported rock ridge above ice valley glacier.

Risk to Forest Operations- Limonite Valley

The forest within the September 1999 rock avalanche path was scheduled for timber harvesting. Similar sites elsewhere in the valley are also proposed for harvesting. A landslide could be triggered by ongoing deformation and displacement of the rock, seismic activity, snow melt or heavy rainfall. Also, the instability along the unsupported rock slopes adjacent to the ice valleys will likely increase with further melting of glacial ice. We do not know when another rock avalanche will occur or down which ice valley glacier it could travel. Forest development within potential rock avalanche tracks thus places workers at risk. Landslide hazard, in the context of probable occurrence and consequence as related to time of exposure, becomes an important variable in determining relative risk. Should workers be informed of the hazards and possible consequences? At what point is the risk deemed unacceptable? Without calculated probabilities for events, is acceptable or unacceptable risk a personnel decision or should the sites simply be precluded from forest harvesting?

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Suggested Reading

Evans, S.G. and J.J. Clague 1994. Recent climatic change and catastrophic geomorphic processes in mountain environments. Geomorphology, Vol.10 (1-4) pp.107-128.

Evans, S.G. and J.J. Clague. 1998. Rock avalanche from Mount Munday, Waddington Range, British Columbia, Canada. Landslide News No. 11. pp. 23-25.