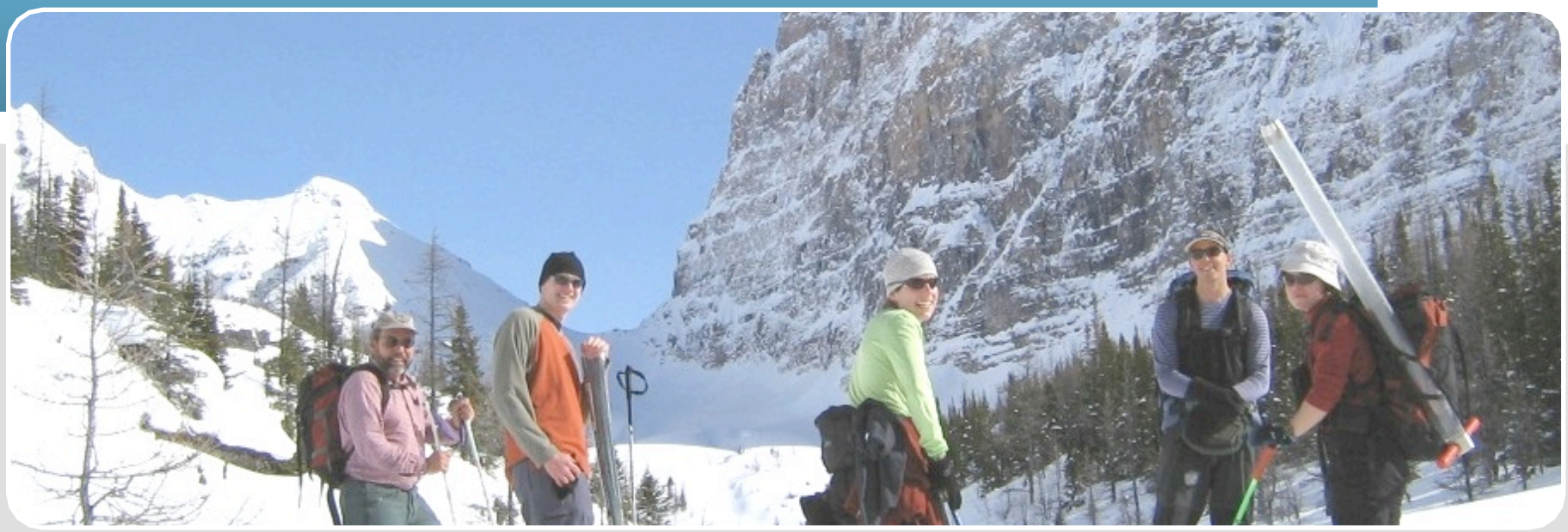
HIDDEN PATHWAYS OF WATER

IN THE LAKE O'HARA BASIN



Lately we hear a lot about climate warming and how it is causing glaciers around the world, including those in the Rockies, to shrink. Some people even say that we will have little water left in mountain streams when glaciers disappear. This is a great concern in western Canada, where we rely on rivers from the Rockies for water supply. However, recent scientific studies suggest that the majority of water in mountain streams is sourced by snowmelt and summer rain. The major concern related to climate warming, according to many hydrologists around the world, is the amount of snow accumulation and the timing of snowmelt. Warmer climate generally results in more rain and less snow, and also later freeze-up and earlier melt. How will these changes affect lakes and streams in the Rockies? This is the question that a team of researchers and students from the University of Calgary is trying to answer.

During summer months, you will see us measuring stream flow and collecting samples from streams and lakes, checking weather stations (photo right), and carrying equipment for geophysical surveys of rock and ice. If you visit Lake O'Hara in late April, you may see us on snowshoes measuring snow depth and density on the Opabin Plateau (photo above). All these activities are part of our study aimed at understanding the sources and pathways of water in the Lake O'Hara Basin.

There are four creeks flowing into Lake O'Hara, (Mary, West and East Opabin, and Oesa) and one stream flowing out (Cataract Brook). During summer months, the lake receives water (inputs) from the four creeks and rain, and loses water (outputs) to Cataract Brook and evaporation. Since the lake level stays more or less constant, total inputs must equal total outputs. Jaime Hood, a graduate student, discovered from careful measurements throughout the summers of 2004 and 2005 that the lake had much higher outputs than inputs. What does this mean? The difference must come from a hidden source. She concluded that Lake O'Hara receives at least 30-70 %, depending on the time of year, of its inputs from groundwater. This finding may change the way hydrologists look at water cycles in alpine systems. Groundwater was commonly ignored in alpine regions because water does not easily flow through bedrock and the soils are so thin. Now we know that groundwater can play an important role.

Inspired by this work, we started looking for evidence of groundwater and found it in many places. Jim Roy, a post-doctoral research fellow, found that the main source of Opabin Creek is a series of springs located west of Hungabee Lake, where groundwater comes out, likely all year round. Interestingly, the chemical composition of groundwater varies widely among the springs even though they are all located within 30 m or so. Jim thinks that the variation is caused by the mixing of two types of groundwater, with one much more enriched in sulphur minerals. As groundwater dissolves minerals as it flows through rocks for a long time, the enriched groundwater may indicate that it spent a larger amount of time underground or that it passed through different types of rocks before re-surfacing.

So, what do all these findings mean? We are still analyzing the results and trying to synthesize them into a conceptual framework, but one thing is clear; groundwater is an important part of the water cycle in the Lake O'Hara Basin, and probably in other similar basins in the Rockies. Our field data suggest that melt water from glaciers and snow, as well as summer rain, is temporarily stored as groundwater before it is released to streams and lakes. This storage occurs in underground reservoirs with large storage capacities, which likely include rocky debris features, such as glacial moraines and talus slopes. It is possible that the groundwater storage may provide a buffering mechanism to alleviate the effects of climate warming on water resources. In order to understand the water cycle and predict what the impacts of climate warming may be, we need to understand the hidden pathways of groundwater in the mountains.

We hope that the Lake O'Hara Basin will serve as a natural laboratory for observing the water cycle and testing our ideas. When you see us on the trails, please feel free to talk to us.

Lake O'Hara Trails Club

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