THESIS

STABLE ISOTOPES AS TRACERS OF HYDROLOGIC SOURCES TO THREE ALPINE LAKES, ROCKY MOUNTAIN NATIONAL PARK

Submitted by

Jennifer Back

Earth Resources Department

In partial fulfillment of the requirements

for the degree of Master of Science

Colorado State University

Fort Collins, Colorado

Spring, 1995

ABSTRACT OF THESIS

STABLE ISOTOPES AS TRACERS OF HYDROLOGIC SOURCES TO THREE ALPINE LAKES, ROCKY MOUNTAIN NATIONAL PARK

Alpine catchments in Colorado's Rocky Mountains play an important role in the regional hydrologic cycle. As much as 20% of Colorado's surface water comes from the small area that lies above timberline. The melting of snow and ice generate a large portion of the surface runoff during spring melt. However, little is known about the hydrologic contributions of temperate glaciers to runoff once spring snowmelt has passed. The stable isotopes, oxygen-18 (^{18}O) and deuterium (D), were used to investigate the hydrologic sources of three alpine lakes in Rocky Mountain National Park, Colorado during the summer of 1991. Two of these lakes had glaciers in their headwaters

Results are reported in per mil (‰) deviations from Standard Mean Ocean Water (SMOW). The δD and $\delta^{18}O$ values for rainfall ranged from -35.5 to -87.5‰ and -5.50 to -13.25‰, respectively. The δD and $\delta^{18}O$ values in glacial melt ranged from -110.0 to -150.0‰ and -15.15 to -25.80‰, respectively The mean δD values for all three lakes were between -118.5 and -127.2‰. Corresponding $\delta^{18}O$ values were between -16.53 and -17.99‰. The mean difference in δD values between inlets and outlets in late summer was -5 to -6‰ for all lakes. Seasonal changes in isotopic composition suggested that both snowmelt and glacial melt contribute to lake volume from July through

September.

Isotopic mass balance techniques indicated that glacial melt contributed approximately 50% of the water to the two lakes with glaciers in their catchments. Similar isotopic values in the lake located in the unglaciated catchment suggested that talus slopes play a far more important role in groundwater storage than has previously been considered

Jennifer
Earth Resources Department
Colorado State University
Fort Collins, CO 80523
Spring 1995