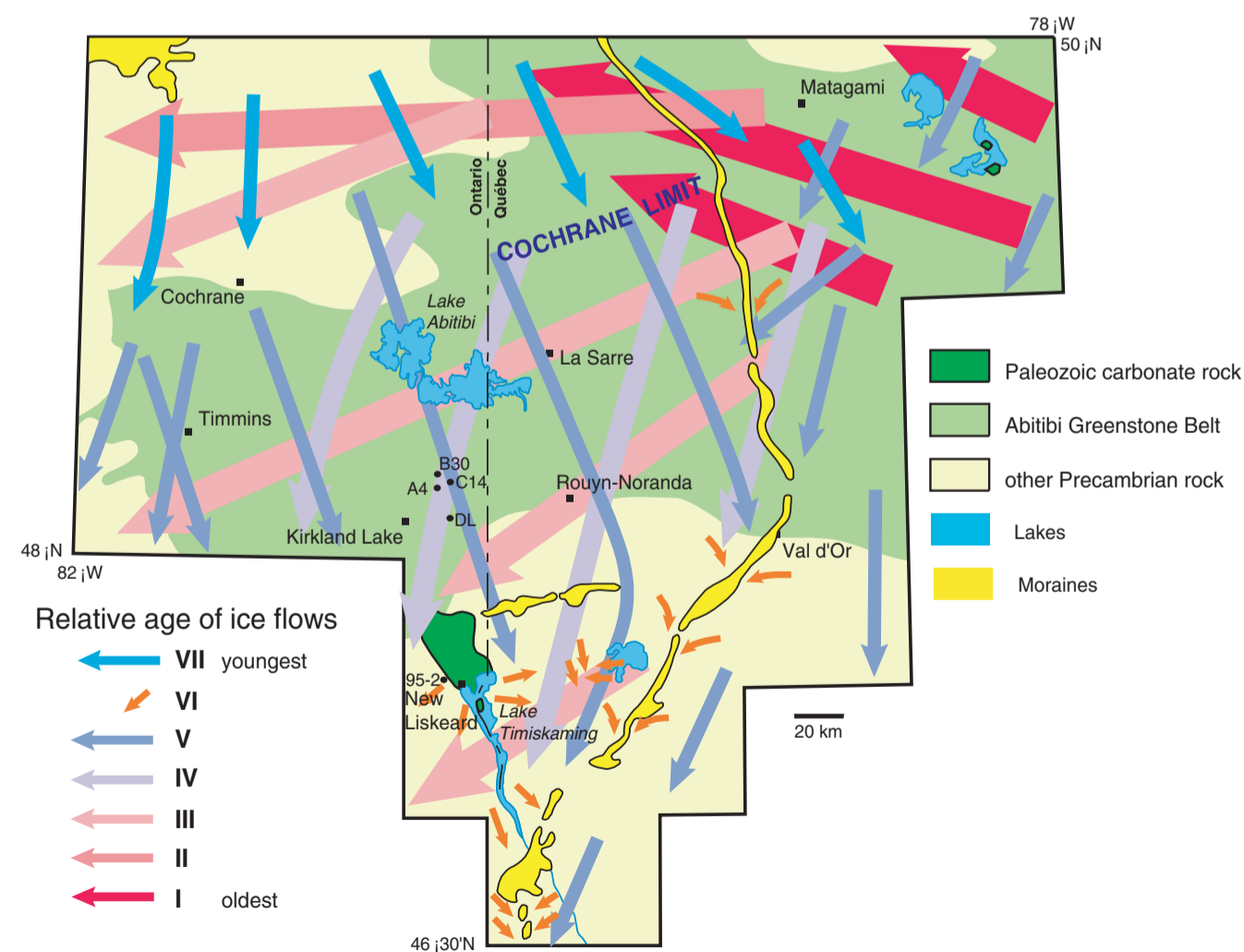
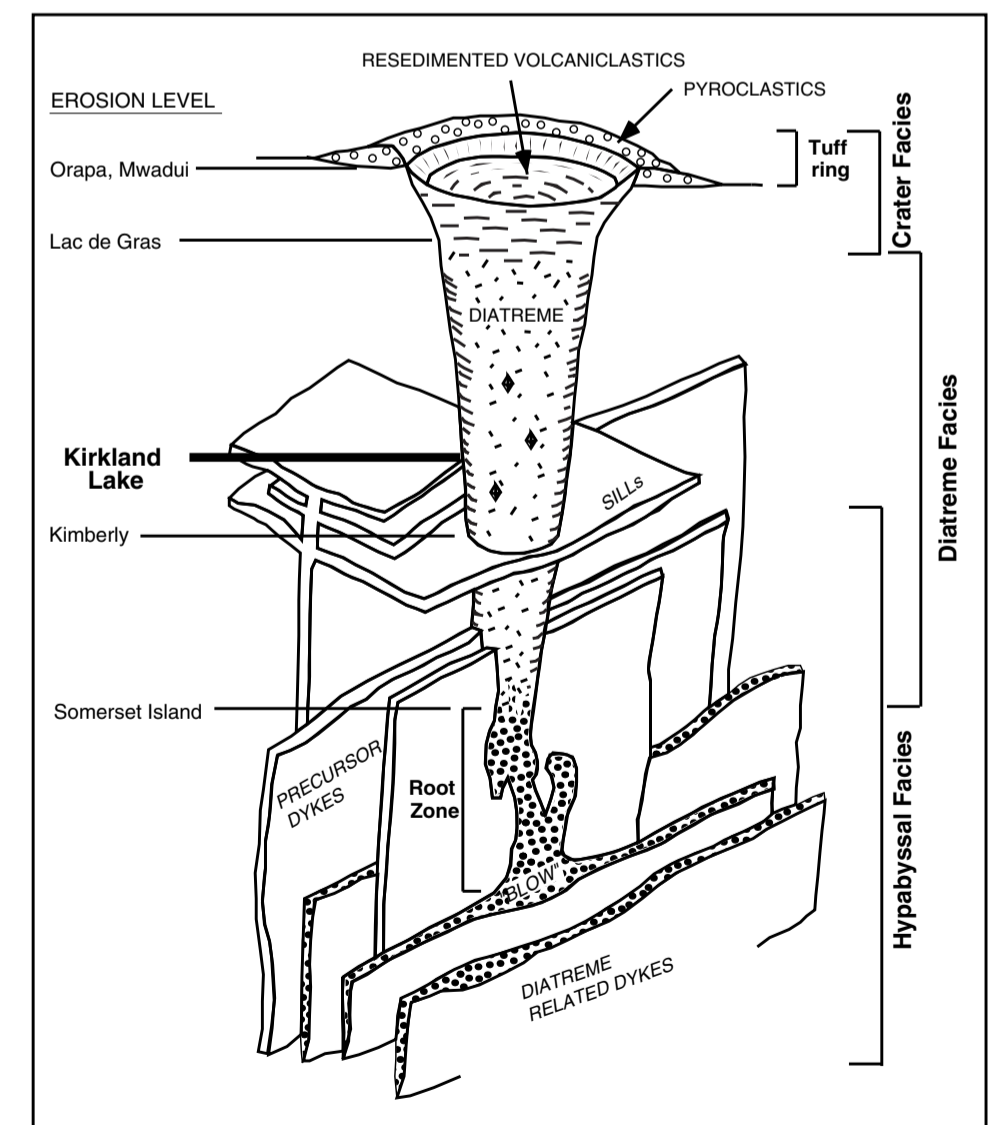


1. Abstract

A hydrogeochemical study of the Lake Timiskaming and Kirkland Lake kimberlite fields was undertaken as part of the Geological Survey of Canada's Targeted Geoscience Initiative (TGI). The goals are to understand the hydrology and geochemistry of groundwater in kimberlites as compared to the surrounding Archean rocks and to develop a useful kimberlite exploration tool. Groundwater from exploration drill holes (drilled in the 1980's and 1990's) was sampled at five kimberlites: B30, C14, A4, Diamond Lake, and 95-2. The waters were measured in the field for pH, oxidation-reduction potential (Eh), dissolved oxygen, electrical conductivity and temperature. Preliminary field results indicate that many pH values are unusually high for natural groundwaters, with pH levels in B30, C14 and A4 in the range of 11.00 to 12.45. Laboratory analysis of the waters were done for major and trace elements, $\delta^{13}\text{C}$, $\delta^2\text{H}$ and $\delta^{18}\text{O}$. Results from $\delta^2\text{H}$ and $\delta^{18}\text{O}$ analysis demonstrate that most waters plot along a local meteoric water line (defined using precipitation data from the Ottawa (OMWL) IAEA station). Kimberlite A4 is the exception with waters that are up to 10 ‰ more enriched in $\delta^2\text{H}$ compared to the OMWL. Reasons for this may include fractionation due to high amounts of OH^- , longer reaction times with rocks or the waters may simply be older waters than the others collected. The $\delta^{13}\text{C}$ analyses indicate enriched ratios in some waters suggesting dissolution of Paleozoic carbonates or an additional source of carbon such as organic acids. For all waters, the amount of potassium increases with increasing pH to a maximum of 39600 ug/L. As K and pH increase, Mg decreases to a minimum value of less than the detection limit. The relationship between K and Mg likely indicates that the Mg is consumed in the formation of brucite, serpentine and diopside and their supersaturation in the waters. The same is true for calcium where the same trend observed with pH vs K/Mg is also seen in pH vs K/Ca.



Regional ice flow patterns for the Western Abitibi region and area of kimberlite exploration (from Veillette and McClenaghan, 1996).



Model of a kimberlite (from Mitchell, 1986) showing present day erosion levels for kimberlites in Kirkland Lake and elsewhere (from McClenaghan et al., 1998).