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# Isotopic and Chemical Composition of Crystalline Shield Fluids: Comparisons of a Granodiorite Pluton with the Canadian and Fennoscandian Shields.

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The isotopic and chemical composition of crystalline shield fluids can be used to examine their origins and evolutionary processes. Cation and anion concentrations of these fluids from the Canadian and Fennoscandian Shields are commonly supplemented by $\delta^{37}Cl$, $^{87}Sr/^{86}Sr$ and, to a much lesser extent, $\delta^{81}Br$ and $\delta^{44}Ca$ to understand host-rock contributions to fluids, fluid mixing, and secondary mineral precipitation/dissolution reactions. Elucidating these processes is crucial for demonstrating fluid longevity and, by doing so, providing insight into overall geosphere stability in crystalline shield rocks.

Here, we compare different fluid components (fracture-water, porewaters, fluid inclusion/grain boundary salts), obtained through out-diffusion and crush and leach experiments in a 2.7-billion-year-old granodiorite pluton, located in within the Canadian Shield, with fluids sampled from across the Canadian and Fennoscandian crystalline shields. Particular focus is given to the isotopic values of $\delta^{37}Cl$, $\delta^{81}Br$, $\delta^{44}Ca$, and $^{87}Sr/^{86}Sr$. We utilize the Precambrian Crystalline Shield Groundwater and Gas Geochemistry Database (PCSG[3]) and data from several Fennoscandian Shield sites to compare with fluids associated with the granodiorite pluton with a focus on $\delta^{37}Cl$ and $\delta^{81}Br$ values.

The fracture waters from the granodiorite body were found to be relatively similar to other crystalline shield fluids, while the porewaters and crush and leach fluids had notable chemical and isotopic differences. Porewaters and crush and leach fluids each had elevated Br/Cl ratios when compared to other crystalline shield fluids but had $\delta^{37}Cl$ and $\delta^{81}Br$ values similar to the rest of the Canadian Shield and Fennoscandian Shield. Both porewaters and crush and leach fluids displayed relationships between $\delta^{44}Ca$ and $^{87}Sr/^{86}Sr$ not seen at any other site in the Canadian or Fennoscandian Shields. Comparisons between the fluid components from the granodiorite body suggest a similar overall source of salinity to other crystalline shield fluids but also suggest a uniquely stable fluid system dominated by water-rock interaction. The results of this work indicate that the granodiorite pluton is highly unaltered. The ultimate source of salinity in crystalline shield fluids is autochthonous in nature, coming from interactions with the host-rock, and these fluids can be quite heterogeneous due to lithological controls on their evolution.