

COMBINED U-Pb AND Hf ISOTOPIC STUDY OF ZIRCON PROVENANCE FROM TILL SAMPLES, NORTHWESTERN SUPERIOR PROVINCE, MANITOBA

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Detrital zircons in till samples from the northwestern Superior Province (NW of Knee Lake) have been analysed for U-Pb and Lu-Hf isotopes to determine provenance and crustal evolutionary history. Two samples sit within the northern Superior superterrane (NSST; at the northern margin of the Superior Province) and three within the Oxford Lake-Stull Lake terrane (OL-SLT) to the south. A total of 235 zircons have been dated by laser ablation ICP-MS, with 224 of these grains analysed for Lu-Hf isotopes by laser ablation multi-collector ICP-MS.

One grain is 475 Ma, and combined with carbonate clasts in the tills confirms some contribution from the Paleozoic cover to the north. A few grains are 1.0-1.4 Ga and 3.1-3.6 Ga, but the majority are 1.6-2.3 Ga (30% of grains) or 2.6-2.9 Ga (57% of grains).

In detail, the largest age population in each sample occurs between 2702 and 2725 Ma reflecting abundant magmatism in the northwestern Superior Province during this interval.

These grains have $\epsilon_{\text{Hf}} = +8$ to -6 with a few -10 to -15 values. The southern samples contain more 2.8-2.9 Ga zircons and these are relatively juvenile with $\epsilon_{\text{Hf}} = +10$ to $+2$. The 3.1-3.6 Ga grains have 0 to -5 ϵ_{Hf} .

Hf model ages (using $\text{Lu}/\text{Hf}=0.012$) for the Neoproterozoic grains are typically 2.6-3.3 Ga, and rarely 3.6-3.8 Ga. Model ages are 2.8-3.1 Ga for the 2.8-2.9 Ga zircons, and 3.6-3.8 Ga for the 3.1-3.6 Ga zircons. These data suggest reworking of up to 3.8 Ga crust to produce the Neoproterozoic magmatic rocks that were the precursors to this detritus. This is similar in age to the oldest zircons dated by previous workers in the NSST. The relatively juvenile nature of the 2.8-2.9 Ga zircons is consistent with previous Nd isotopic studies in the OL-SLT demonstrating that 2.8-2.9 Ga magmatism was juvenile, contrasting strongly with adjacent terranes.

The largest Proterozoic peaks occur at 1.82-1.93 Ga. These zircons have ϵ_{Hf} values of $+8$ to -19 and 2.0-3.3 Ga Hf model ages. These data suggest that Proterozoic crust was in part juvenile and in part reworked much older Archean crust. A similar pattern is observed in the Superior boundary zone and adjacent Kisseynew domain of the Trans-Hudson orogen.

Combined U-Pb and Hf isotopic data allow a more accurate reconstruction of provenance in detrital samples than U-Pb data alone, and in this case suggest relatively local origin for zircon from till samples in the far northwestern Superior Province.