

## Hf Isotopes in Zircon and Archaean Crustal Growth in the Western Superior Province

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U-Pb zircon ages have documented in detail the 2.6-3.2Ga igneous history of the Superior province. This is thought to have involved accretionary crustal growth of the central (Winnipeg River and Wabigoon sub-provinces) and southern (Wawa and Abitibi sub-provinces) Superior province against an Andean-type margin (Uchi and Berens sub-provinces), which developed on a juvenile 3.0 Ga crustal block in the north (Sachigo sub-province). Convergence produced intervening accretionary or foreland sedimentary belts such as the Quetico and English River sub-provinces. Early TIMS Hf isotopic studies on zircon confirmed that the southern Abitibi sub-province is juvenile while the Uchi sub-province evolved over a 300Ma time span from mantle-derived magmas and remobilised 3.0Ga crust (Corfu and Stott 1996; Corfu and Noble 1992). To further test this model, Hf isotopes were measured on dated zircons from 62 rock units in the western Superior region plus 25 detrital zircon grains from 2.7Ga orogenic sandstones in the Quetico sub-province and pre-2.8Ga quartz arenites, which form an early platformal assemblage associated with older crustal blocks. The mass spectrometer analyses were done over a four day period using the Plasma54 instrument at the NERC lab, and expand the available Hf database in the western Superior by a factor of four.

Most data from 2.7Ga greenstones in the western Wabigoon sub-province cluster around a depleted mantle Ehf value of +6.5, confirming previous indications that this represents a juvenile oceanic terrane. Ehf values in zircons from 3.0Ga old rocks in the central Wabigoon sub-province cluster around a depleted mantle value (at 3.0 Ga) of +5.5. Zircons from ca. 2.9Ga rocks having plume-like geochemical signatures give slightly less depleted values down to +4. These data overlap with results from similar aged rocks in the Sachigo sub-province, supporting the suggestion that parts of the 3.0Ga central and northern Superior blocks are correlative and have been tectonically transported across the accretionary margin. This conclusion is also supported by recent Lithoprobe seismic reflection data.

In contrast, zircons from the Winnipeg River sub-province, a high-grade meta-plutonic terrane that contains the oldest Superior province rocks yet dated, show noticeably more enriched Hf than those from other terranes, with Ehf values of about 0 to -2 over an age range of 2721Ma to 3225Ma. An Ehf value of -2 value found on 3.2Ga zircons from the oldest gneiss implies a ca. 3.5Ga crustal protolith, in agreement with results of Nd whole rock isotopes (Henry et al. 1997). This suggests that the Winnipeg River sub-province represents an older exotic terrane.

Results on 2.8-3.0Ga detrital zircons from quartz arenites in the Sachigo sub-province generally overlap the data field from igneous rocks in this area. Ca. 3.2Ga zircons from the Quetico metasediments show Ehf values as enriched as -3, while the youngest 2.7Ga zircons show variable enrichment from +5 to +0. This suggests that the provenance of Quetico turbidites was at least partially in the Winnipeg River terrane. Surprisingly, NeoArchaean juvenile terranes do not appear to have been a major source.

The general coherence of the highest Ehf values at 2.7Ga and 3.0Ga provides constraints on the evolution of the late Archaean depleted mantle reservoir beneath the Superior province. These results agree with linear growth trends defined by Hf data from early Archaean and younger rocks elsewhere. They give evidence of a major depletion of the mantle at about 4.0Ga.

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