Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10033, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10033
EGU General Assembly 2008


# Secular evolution of continental crust from Hf and O isotopes in zircon from Slave Province, Canada

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Understanding secular evolution of continental crust requires knowledge of how crust is formed and recycled, what is the composition of a new crust and its residence time. Two-stage Nd model ages of sediments and two-stage Hf model ages of zircons provide information on timing of a new crust extraction from mantle. However, many of model ages is hybrid due to mixing between different crustal and mantle reservoirs. Zircons with mantle $d^{18}O$ values (5.0-5.6‰, Valley et al. 2005) are more likely to preserve Hf model ages that reflect actual crust forming events.

We present coupled Hf and O isotope analyses in detrital zircons from Slave Province to assess the nature of continental crust generation events in the area. Zircons range in age from 2812 Ma to 3918 Ma, and the age distribution forms a number of peaks consistent with at least 6 magmatic episodes (Sircombe et al. 2001). The distribution of zircon ages does not correspond to the distribution of Hf model ages. Zircons with mantle $d^{18}O$ values ranging in age from 2.8 Ga to 3.5 Ga from two linear arrays in age versus initial $^{176}Hf/^{177}Hf$ plot corresponding to Hf model ages of $\sim$3.4 Ga and $\sim$3.8 Ga and $^{176}Lu/^{177}Hf$ of the source varying from 0.025 to 0.027. The implications are that (a) new continental crust in Archean was generated in two separate episodes and (b) the composition of the crust was mafic. Hf model ages of zircons with $d^{18}O>$ 5.6‰ and calculated using $^{176}Lu/^{177}Hf$ constrained by low $d^{18}O$ zircons vary from 3.3 Ga to 4.5 Ga. Despite all zircons with the lowest initial $^{176}Hf/^{177}Hf$ at given time having $d^{18}O>$ 5.6‰ they form a consistent, linear array corresponding to Hf model

age of 4.4-4.5 Ga and $^{176}$Lu/$^{177}$Hf=0.024. It is in agreement with the presence of a component that is inferred to be the oldest crust sampled by the zircons analysed in this study that was derived from the mantle at 4.4-4.5 Ga. Such an age of protocrust extraction is in agreement with data from Jack Hills zircons (e.g. Harrison et al. 2005) and $^{142}$Nd anomaly in Isua formation in Greenland (Boyet and Carlson 2006, Caro et al. 2006).

Comparison of Slave data with Hf data from Gondwana (Kemp et al. 2006), Superior Province (Davis et al. 2007), Limpopo Belt (Zeh et al. 2007) and other Archean terrains (Amelin et al . 2000) shows that the mafic crust formation between 3.3 and 3.8 Ga is common for many areas and crust formed at this period was stabilized and recycled for at least 1.5 Gy. The range of $^{176}$Hf/$^{177}$Hf values in zircons increases through time in Archean indicating that both extraction of new material from mantle and reworking of the older crust is important for the secular evolution of the continental crust.

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