Crust-mantle evolution in NW Spitsbergen: Re-Os, U-Pb and Hf isotope data

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In situ isotopic analyses have been carried out on sulfides in mantle xenoliths and on detrital zircons from NW Spitsbergen to explore the relationship between thermal events in the sub-continental lithospheric mantle and the overlying crust. *In situ* Re-Os analysis on mantle sulfides indicate multiple events from Archean (*ca* 2.9 Ga) to Phanerozoic age (*ca* 0.4 Ga). The oldest sulfide population preserved in most depleted peridotites (*ca* 2.7-2.9 Ga), represents a minimum age for the oldest melt depletion event. The sulfide populations between *ca* 1.3-1.7 Ga broadly correlate with the recorded crustal ages, while the sulfide populations *ca* 1.8-2.3 Ga have no crustal equivalent, suggesting that they may result from overprinting of older sulfide populations by metasomatic addition of radiogenic Os. One significant age population (T_{MA} model age *ca* 0.94 Ga) correlates well with a major crustal tectonic event. The youngest sulfide population (T_{RD} model age *ca* 0.59 Ga) may represent refertilisation of the lithospheric mantle by metasomatic fluids introduced during Caledonian time.

Detrital zircon grains were collected from outwash streams of the Adolfbreen glacier that covers a large area of outcropping local crustal rocks (Hecla Hoek formation). *In situ* U-Pb and Hf isotope analysis on these zircons show that the oldest population has Archean inherited ages (*ca* 2.5-2.9 Ga) similar to the the oldest mantle sulfide population. The Grenvillian zircons (*ca* 0.94 Ga) have Hf isotope compositions that indicate reworking of older continental crust without juvenile input. In contrast, the Hf isotope composition of zircons *ca* 1.3-1.8 Ga show juvenile magma input as well as reworking of pre-existing continental crust. Several Caledonian events (*ca* 0.58-0.32 Ga) also reveal both juvenile input and a reworked component.

Therefore the major mantle events correspond in timing with crustal melting and reworking episodes indicating that tectonic events affected the whole lithospheric column in this region since *ca* 2.9 Ga.