Zircon U-Pb, Hf and O isotope constraints on growth versus recycling of continental crust in the Grenville orogen, Ohio, USA

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The Grenville orogen extends along the present day North American continent, from Labrador in the north to Mexico in the south. It is, however, largely covered by thick piles of Phanerozoic rocks, and the geological evolution of the extensive covered parts of the orogen is poorly known. We present zircon U-Pb, Hf- and O-isotope analyses for six drill-cores in Ohio (USA). U–Pb data dates magmatic and metamorphic zircon crystallization that span from 1643 ±54 Ma to 1025 ±8 Ma. Zircon $\varepsilon Hf_{(t: 1650\text{-}1025\ Ma)}$ values at 1.9 ±1.2 to 9.0 ±0.6 is explained by reworking of a single crustal reservoir derived from the mantle at 1640 ±40 Ma, that evolved with a $^{176}Lu/^{177}Hf$ value of 0.014. One sample, deviates from this trend and its spread in εHf t=1230 Ma indicates a 0-33 wt% contribution of a depleted mantle component to the t_{DM}=1650 Ma reservoir. Zircon (SIMS) $\delta^{18}O$ weighted mean values range from 5.36 ±0.65‰ to 10.88 ±0.21‰, which corresponds to juvenile mantle and recycled crustal oxygen signatures respectively. There is a broad negative correlation between zircon Th/U and $\delta^{18}O$ and age respectively. The general increase in $\delta^{18}O$ with time and progressive metamorphic recrystallization is best explained by the increasing effect of heavy $\delta^{18}O$ metamorphic fluids during Grenvillian continent-continent collision. Together, the new data presented here suggests that the crustal evolution of this part of the North American continent is significantly older, and that the influence of metamorphic fluids on the O-isotope system in zircon is stronger than previously reported.

Glacial interglacial aerosol input over Antarctica and the global hydrological cycle

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Questions rise for simulating and interpreting the 5 fold marine and the 50-to-70 fold dust enhancement observed from Antarctic ice core records during the past glacial interglacial cycles. Amongst uncertainties the repective contribution from source, from transport which would be consistent for aerosols of different origin are challenging.

A semi-empirical model has been developed to reproduce the large glacial-interglacial changes of Antarctic dust and sodium concentrations [1]. Tthe model uses a life-time parameter that depends on atmospheric temperature (stable isotope content of ice) which drives the global hydrological cycle and the atmospheric cleansing and which was applied to conceptual pathways for aerosols.

The model reproduces most of the increase in dust concentrations during cold periods with respect to Holocene climate, as observed in Epica Dome C (EDC) and Vostok ice records, on the basis of synergetic changes of three factors associated with temperature (source, transport efficiency, accumulation rate over Antarctica). As supportive results, our model provide source amplitude (up to X 4) and mimics the pattern of a south Atlantic marine record covering the last 300, 000 yr (Martinez Garcia, 2009) along with consistent 3-5°C atmospheric temperature change over the Southern Ocean [2]. The calculated source changes (mostly Patagonia) share the pattern of the sea ice extends over the south Atlantic.

When applied to the sodium, the concentration changes could be reproduced by our model by using two main factors (accumulation rate and transport efficiency) while the source effect is not discernable from an atmopheric temperature effect.

[1] Petit, J.R. and B. Delmonte (2009) *Tellus* **61B**, 768–790. [2] Martinez Garcia *et al*. (2009) *Paleoceanograpghy*, **24** PA 1207.