Geophysical Research Abstracts
Vol. 14, EGU2012-799-1, 2012
EGU General Assembly 2012

Not all supercontinents are created equal: Nd and Hf depleted mantle model ages reveal fundamental differences in the assembly of Rodinia and Gondwana

C. Spencer (1), P. Cawood (1), C. Hawkesworth (1), B. Dhuime (1,2)

(1) Department of Earth Sciences, University of St. Andrews, North Street, St. Andrews KY16 9AL, UK (cs207@st-andrews.ac.uk), (2) Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queens Road, Bristol BS8 1RJ, UK

Hf isotopes in zircon show a strong relationship with the 87Sr/86Sr ratios of seawater through time in that periods of low zircon "Hf values also show more crustal 87Sr/86Sr ratios. This implies the mechanisms that drive these isotopic systems are linked in similar Earth processes. In turn, the Sr isotopic record in seawater and global zircon Hf averages have been proposed as proxies for the formation and destruction of supercontinents. During supercontinent assembly, when subaerial exposure of the continent and the degree of magmatic crustal reworking is maximized, the 87Sr/86Sr ratio of seawater and the evolved signature of Hf isotopes in zircon should increase and vice versa as supercontinents break apart (Condie, 2011; Roberts, in press). Although this relationship is found during the assembly of Gondwana from the Pan-African orogeny, it is not seen during the growth of Rodinia and the Grenville orogeny. One explanation for this is the ages of material involved in the assembly of supercontinents were different and so had different isotopic signatures. If an orogen reworked young material then the zircon Hf and 87Sr/86Sr would not show a strong excursion to more crustal values than if the orogen incorporated much older material with more extreme isotope ratios.

To quantify the relative proportions of young versus old material in these orogenies, depleted mantle model ages of whole rock Nd in felsic rocks and zircon Hf derived from the Pan-African and Grenville orogenies are normalized to equate the ages of the contributing material to the beginning of each orogeny. Integration of probability density plots reveal the Grenville orogeny contains between 56% (zr Hf) and 60% (WR Nd) of pre-900 Ma depleted mantle ages. Conversely the Pan-African orogeny has between 61% (WR Nd) and 69% (zr Hf) of post-900 Ma material. The division of 900 Ma is chosen simply because there is a slight trough of depleted mantle ages from the beginning of each orogeny. These normalized percentages imply the Hf and Nd isotopic signatures of the assembly of Rodinia are not as prominent as that for the assembly of Gondwana simply because the age of the material involved in the reworking and collision were relatively younger for the Grenville orogeny and older for the Pan-African orogeny. This also implies the 87Sr/86Sr record cannot be used to identify periods of supercontinent formation. It is therefore apparent, that simple comparison of isotopic signatures cannot accurately identify periods of increased continental amalgamation.