Crustal growth and recycling during supercontinent cycles: evidence from detrital zircon Hf-isotope data from the Damara Orogen

DAVID A. FOSTER* AND PAUL A. MUELLER

Department of Geological Science, University of Florida, Gainesville, Florida 32605 USA
(*correspondence: dafoster@ufl.edu)

Orogenic belts formed during the Rodinia to Gondwana supercontinent cycle harbor information about the construction and recycling of continental crust. U-Pb ages and Hf-isotopic compositions of detrital zircons reflect contributions from recycled and juvenile crust within the orogenic belts. Neoproterozoic strata of the Damara Sequence, which was deposited along the southern and orogenic belts. Neoproteorozoic strata of the Damara

populations range from strongly negative to positive values. Each of the 800-700 Ma grains (values as low as -20) and the 800-700 Ma populations include a mixture of juvenile and ancient crustal materials. A relatively larger fraction of juvenile material is represented in the detritus derived from syn-rift magmatism associated with opening of the Khamos Ocean. Results from latest Neoproterozoic to Cambrian Nama Group strata deposited in the foreland basin to the Damara Orogen mirror the zircon populations in the Damara Sequence. The Nama Group also contains ca. 570-530 Ma zircon with negative epsilon Hf. These data suggest that most of the material involved in the Damara Orogen was recycled from the earlier Proterozoic events and syn-rift magmatism. Our results suggest that the Grenvillian-Kilbaran and Pan-African events in the Damara-Zambezi Orogen recycled large fractions of older crust along with some juvenile crust, and that significant juvenile crust formed during Neoproterozoic rifting of Rodinia, which was subsequently cratonized during the accretion of Gondwana.


dCO2 and climate; Evidence from boron based proxies of pH and dCO2

GAVIN L. FOSTER1* OSAMU SEKI23, RICHARD D. PANCOST2 AND DANIELA N. SCHIMDT1

1Department of Earth Sciences, University of Bristol, Bristol, BS8 1RJ, UK (*correspondence: g.l.foster@bristol.ac.uk)
2Faculty of Environmental Earth Science, Hokkaido University, Hokkaido, Japan
3School of Chemistry, University of Bristol, BS8 1TS, UK

Identifying the role of atmospheric CO2 in determining the climate of the past, particularly during time periods when the Earth was warmer than today, has been recognised as a key way in which to better predict the climate of our warming future. However, accurate reconstructions of pCO2 beyond the reach of the ice cores is a notoriously difficult task. What is needed is a robust proxy that can be easily correlated with other climatic archives and can be applied at a suitable temporal resolution. The isotopic composition of boron (δ11B) and its concentration (B/Ca) in foraminifera recovered from ocean sediments however have the potential to fulfill this role. The boron isotope palaeo-pH proxy has a firm theoretical basis and is dependant on the known pH dependant speciation of boron in seawater and the isotopic fractionation that exists between the two aqueous boron species [1]. Accurate determination of δ11B is however hampered by a number of analytical difficulties. A new measurement protocol using multi-collector inductively coupled mass spectrometry (MC-ICPMS), overcomes many of the problems that plague traditional δ11B measurement approaches [2]. This advance is particularly timely since it has also been recently recognised that the B/Ca ratio of foraminifera is a proxy for [CO32-] and its concentration (B/Ca) in foraminifera recovered from ocean sediments however have the potential to fulfill this role. The utility of the combined δ11B and B/Ca approach will be illustrated here with examples from key time periods throughout the Cenozoic, with a focus on the Mid Pliocene. Particular attention will be placed on how the boron based proxies compare to other pCO2 proxies (e.g. δ34S of alkenones), the limitations of the approach used, and what can be learnt from these multi-proxies records about how pCO2 controls climate in the geological past.