Continental growth spurts during supercontinent break-up

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Accretionary orogens are the primary host of both growth and loss of continental crust, at least since the Archaean. At present-day, growth and loss are balanced globally, leading to a constant continental volume [1]. Retreating accretionary orogens will feature greater continental growth than those in advancing mode (e.g. [2, 3]). Continental growth largely occurs via subdcuction-driven magmatism, whereas continental loss largely occurs via subduction erosion and sediment subduction. Since the latter typically involves partial recycling into magmas, both growth and loss of continental crust are represented in the magmatic record.

Using a global zircon-Hf datset [4], the magmatic record preserved in zircons is examined to determine the relative amount of global continental growth versus recycling. Excursions into positive and negative εHf-time space relative to a global mean, represent increased continental growth and recycling respectively. The data show strong negative excursions at ~2.0-1.7 Ga, ~1.0 Ga, and ~550 Ma, reflecting increased continental recycling during periods of supercontinent amalgamation. Well-defined positive excursions are seen at ~1.7-1.3 Ga and ~0.8-0.6 Ga, interpreted as increased continental growth-rate during periods of supercontinent break-up, and likely reflecting an increased degree of retreating accretionary orogens. The Archaean lacks strong positive or negative excursions, reflecting either a lack of supercontinent formation, or a differing role of accretionary orogenesis during this period.

Preservational bias during the supercontinent cycle may lead to an increased zircon record during supercontinent formation [5]; however, the degree of mantle input recorded by Hf-in-zircon indicates that continental growth-rate is actually increased during supercontinent break-up. Elucidating the exact degree of continental loss through Earth history remains a challenge, but is vital for determining the true nature of continental growth.

[1] Hawkesworth *et al.* (2010) *Jour. Geol. Soc. London* **167**, 229–248. [2] Kay *et al.* (2005) *Geol. Soc. Am. Bull.* **117**, 67–88. [3] Kemp *et al.* (2009) *EPSL* **284**, 455–466. [4] Belousova *et al.* (2010) *Lithos* **119**, 457–466. [5] Hawkesworth *et al.* (2005*) Science* **323**, 49–50.

Marine controls on atmospheric radiocarbon: The glacial and deglaciation

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Radiocarbon is an important isotope because its radioactive decay provides constraints on the rates and timing of processes today and in the past. It is well mixed in the atmosphere, where its history is reasonably well constrained back through the last 50,000 years. By contrast the radiocarbon content of the ocean varies by about 150 per mil depending on equilibration with the atmosphere and subsequent isolation that allows decay to proceed.

There is evidence for an even greater dynamic range in the marine realm during the last glacial and deglaciation. For example, published records from intermediate waters in the northern hemisphere are up to 500 per mil depleted relative to the contemporaneous atmosphere, and have been used as evidence for a isolated, carbon-rich reservoir in the deep ocean. There is little doubt that interaction with the ocean is a major driver of atmospheric CO_2 and radiocarbon on these timescales, but the mechanisms continue to be debated in the literature. In this abstract we focus on building a coherent compilation of the state-of the-art of marine radiocarbon records, and then use these records to discuss potential mechanisms for abrupt changes in atmospheric carbon and radiocarbon.