ABSTRACT

The rate of growth of the continental crust is controversial. We present an evaluation of time-constrained analyses of oxygen isotopes in zircon grains and incompatible element (Zr, Th) concentrations in magmatic rocks to test for variations in the degree of crustal recycling through geological time. The data indicate a rise in these geochemical proxies from ca. 3.0 Ga to a statistically significant peak at 1.2–1.1 Ga during the amalgamation of supercontinent Rodinia, and a decrease thereafter. When combined with other geological and geophysical observations, the data are interpreted as a consequence of an unprecedented level of crustal recycling and sediment subduction during Rodinia assembly, arising from a "Goldilocks" (i.e., just right) combination of larger, thicker plates on a warmer Earth with more rapid continental drift relative to modern Earth. The subsequent decrease in $\delta^{18}O$, Zr, and Th measurements is interpreted to reflect decreasing drift rates on a cooling Earth.

is unknown whether crust grew in pulses associated with periods of supercontinent assembly (Stein and Hofmann, 1994; Condie, 1998), or whether the episodic record is an artifact of preservation (e.g., Hawkesworth et al., 2009). Nonetheless, recent studies indicating periods of enhanced exchange between the lower and upper mantle lend support to the epi-

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