

Secular evolution of the rates of generation and destruction of the continental crust

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The continental crust has evolved for billions of years to produce the environment we live in and the resources we depend on, and yet how and when it formed remain a matter of great debate. Less than 5% of the geological record consists of rocks older than 3 Ga, there are no known rocks older than 4 Ga, and in contrast recent models of continental growth suggest that at least ~60-70% of the present volume of the continental crust had been generated by 3 Ga. Such models imply that large volumes of pre-3 Ga crust were destroyed and replaced by younger crust since the late Archaean.

In this contribution we evaluate the influence of changing rates of continental crust generation and destruction over the rocks record through time. We considered two types of continental crust [1], i) pre-3 Ga relatively thin (~20 km) and predominantly mafic crust, and ii) post-3 Ga thicker (~35 km) and more differentiated crust. We adopted a Monte Carlo approach to generate a large ensemble of crust formation and destruction rates in 300 Myr increments, in a model constrained by the estimated volumes of the continental crust at 3 Ga and the present day, and the distribution of crust formation ages in the present day crust. New continental crust was generated continuously, but with a marked decrease in the growth rate of continental crust at ~3 Ga. Destruction rates dramatically increased from the onset of plate tectonics around 3 billion years ago, and the volume of continental crust may have exceed its present value by the mid/late Proterozoic.

[1] Dhuime et al. 2015, Nature Geoscience 8, 552-555