Geophysical Research Abstracts
Vol. 20, EGU2018-4046, 2018
EGU General Assembly 2018

A plate tectonic interpretation of the supercontinent cycle: measuring subduction length, rift length and connectedness of continental lithosphere

Andrew Merdith (1), Simon Williams (1), Sascha Brune (2), Alan Collins (3), and Dietmar Müller (1)

(1) The University of Sydney, School of Geosciences, Sydney, Australia (andrew.merdith@sydney.edu.au), (2) GFZ German Research Centre for Geosciences, Potsdam, Germany, (3) Centre for Tectonics, Resources and Exploration, Dept of Earth Sciences, The University of Adelaide, SA 5005, Australia

The supercontinent cycle is a key concept in the ongoing effort to unify plate tectonic theory with the evolution of the mantle, atmosphere and oceans. However, there is still ambiguity about what exactly defines a 'supercontinent', and how their existence can be traced through time. Previous studies have typically used snapshots at specified times to extract metrics pertinent to 'measuring' tectonics, but none of these metrics continuously covered several supercontinent cycles.

Using pyGPlates and recently proposed full plate models between 1000 and 0 Ma, we extract three metrics that may be useful in further understanding the supercontinent cycle: (1) the length of subduction zones along the margin of continental lithosphere, (2) the length of rift systems, and (3) the perimeter-to-area ratio of continental lithosphere. Our results distinguish times of supercontinent existence (Rodinia/Gondwana/Pangea) from the perimeter-to-area ratio and the breakup of Rodinia and Pangea from rift lengths. It is difficult to define the assembly of Pangea from our results; yet the assembly of Gondwana (ca. 520 Ma) marks the most prominent change in subduction zone length and perimeter-to-area ratio, suggesting that the traditional understanding of the supercontinent cycle may be incomplete to fully describe the cycle. Instead, our results suggest that either a two-stage supercontinent cycle could be a more appropriate description, or that the time period of 1000 to 0 Ma is dominated by supercontinent existence, with brief periods of dispersal and amalgamation. In addition to better understanding the supercontinent cycle, untangling the temporal and spatial relationships between subduction and rifting could help elucidate processes of supercontinent breakup and isolate tectonic effects on climatic changes.