Seminar by,
Dr. Kurt Sundell

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Global Records of Hafnium Isotopes in Zircon Shed Light on Earth's Deep Past

Biosketch: Dr. Sundell's research interests include tectonic processes, interrogated through the lens of the sedimentary record. His research is usually field based, and complemented by a variety of analytical methods including U-Th-Pb geochronology, Lu-Hf and trace element geochemistry, stable isotopic analysis (O and H), and (U-Th)/He thermochronology.

Abstract: The assembly and dispersion of continental crust exert first-order controls on paleogeography and geochemical cycles. The associated reworking of Earth's crust can be tracked with zircon initial hafnium (εHft) through space and time. Here we apply a new method for quantitative analysis of εHft density estimates based on a compilation of 155,061 εHft values. Investigation of the global database reveals geographic and temporal bias in the εHft record associated with sampling and regional tectonic events. Recent research has attempted to address global εHft bias using resampling methods to augment gaps of low εHft data density, which in turn obfuscates tectonic signals and artificially weights outliers. Instead, we evaluate εHft density patterns for both igneous and detrital zircon on eight continental zones demarcated by Paleozoic sutures: Africa, Antarctica, Asia, Australia, Baltica, North America, Peri-Gondwana, and South America. Pairwise two-dimensional quantitative comparison highlights similarity in timing and εHft values between zones, all of which can be linked to documented shared regional tectonism. Integration of all pairwise comparisons reveals that peak similarity corresponds to the timing of supercontinent amalgamation, and that the associated εHft differs depending on the style of supercontinent amalgamation, particularly internal versus external orogenesis. The three most recent supercontinents produced distinctive εHft signals, shared by the constituent continents. The supercontinents Rodinia and Pangea were constructed through collisions of marginal arc terranes, peripheral to ancient crust, and did not produce highly enriched εHft values. In contrast, Ediacaran to Cambrian formation of the Gondwana supercontinent was largely the product of internal Pan-African orogens that formed directly after Neoproterozoic Rodinia rifting and arc accretion forming the Arabian Shield. The final assembly of Gondwana was dominated by continent-continent collisions of old radiogenic crust without establishment and accretion of extensive intervening depleted arc terranes, resulting in a more enriched distribution of εHft values compared to prior and subsequent supercontinent formation. The secular εHft record is the product of spatiotemporally biased sampling and preservation of specific orogenic belts with predictable εHft data arrays, modulated by the amalgamation, tenure, and breakup of supercontinents through time.

Date: Friday September 2nd 2022
Time: 4:00 – 4:50 PM
Zoom Meeting ID: 990-1912-5163

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