The assembly of Pannotia: a thermal legacy for Pangaea?

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Controversy about the status of Pannotia (Laurentia + Baltica + Gondwana) as an Ediacaran supercontinent centers on palaeomagnetic data (which is permissive not conclusive) and geochronology (which implies breakup commenced before full assembly). But evidence of past supercontinent assembly is not limited to these two criteria and can be found in many other phenomena that accompany the process. Irrespective of whether Pannotia qualifies as a supercontinent, a key unanswered question is whether the legacy of its amalgamation influenced global mantle convection patterns because such patterns are generally ignored in models claiming the transition from Rodinia to Pangaea represents a single supercontinent cycle. We contend that the proxy signals of assembly and breakup in the Ediacaran are unmistakable and indicate profound changes in mantle circulation. These changes correlate with a wealth of geologic data for Pan-African collisional orogenesis, reflecting the amalgamation of the Gondwana, and for tectonothermal activity along the Gondwanan portion of Pannotia’s periphery.

Collisional orogenesis necessitates subduction of oceanic lithosphere between the converging continental blocks. By analogy with the amalgamation of Pangea, the subducted oceanic lithosphere should have congregated to form a “slab graveyard” along the core-mantle boundary that would have generated a superplume beneath the Gondwanan component of Pannotia, the effects of which can be seen along its margins. We suggest that such dramatic changes in mantle convection patterns can indeed be recognized, they provide insights into the processes responsible for the opening of the Iapetus and Rheic oceans, and a potential explanation for some of the enigmatic tectonothermal events that characterize the Late Neoproterozoic-Early Paleozoic tectonic evolution of the margin of Gondwana.