The Mutare-Fingeren Dyke Swarm: the enigma of the Kalahari Craton's exit from supercontinent Rodinia

Ashley Gumsley, Michiel de Kock, Richard Ernst, Anna Gumsley, Richard Hanson , Sandra Kamo, Michael Knoper, Marek Lewandowski, Bartłomiej Luks, Antony Mamuse, and Ulf Söderlund.

Abstract

The Rodinia supercontinent broke apart during the Neoproterozoic. Rodinia breakup is associated with widespread intraplate magmatism on many cratons, including the ca. 720-719 Ma Franklin large igneous province (LIP) of Laurentia. Coeval magmatism has also been identified recently in Siberia and South China. This extensive magmatism terminates ~1 Myr before the onset of the Sturtian Snowball Earth. However, LIP-scale magmatism and global glaciation are likely related. U-Pb ID-TIMS baddeleyite dating herein identifies remnants of a new ca. 724-712 Ma LIP on the eastern Kalahari Craton in southern Africa and East Antarctica: the combined Mutare-Fingeren Dyke Swarm. This dyke swarm occurs in north-eastern Zimbabwe (Mutare Dyke Swarm) and western Dronning Maud Land (Fingeren Dyke Swarm). It has EMORB-like geochemistry, suggesting an asthenosphere mantle source for the LIP. The Mutare-Fingeren LIP likely formed during rifting. This rifting would have occurred almost ~100 Myrs earlier than previous estimates in eastern Kalahari. The placement of Kalahari against south-eastern Laurentia in Rodinia is also questioned. Proposed alternatives, invoking linking terranes between Kalahari and south-western Laurentia or close to north-western Laurentia, as alternative scenarios, also present challenges with no discernible resolution. Nevertheless, LIP-scale magmatism being responsible for the Sturtian Snowball Earth significantly increases.