# North America's Midcontinent Rift: when rift met LIP

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Rifts are segmented linear depressions, filled with sedimentary and igneous rocks, that form by extension and often evolve into plate boundaries. Flood basalts, a class of Large Igneous Provinces (LIPs), are broad regions of extensive volcanism due to sublithospheric processes. Typical rifts are not associated with flood basalts, and typical flood basalts are not associated with significant crustal extension and faulting. North America's Midcontinent Rift (MCR) is an unusual combination. Its 3000-km length formed as part of the 1.1 Ga rifting of Amazonia (Precambrian northeast South America) from Laurentia (Precambrian North America) and became inactive once seafloor spreading was established, but contains an enormous volume of igneous rocks. MCR volcanic rocks are significantly thicker than other flood basalts, due to their deposition in a narrow rift rather than across a broad region, giving the MCR a rift's geometry but a LIP's magma volume. Structural modeling of seismic reflection data shows an initial rift phase where flood basalts filled a fault-controlled extending basin, and a postrift phase where volcanics and sediments were deposited in a thermally subsiding sag basin without associated faulting. The crust thinned during the rifting phase and rethickened during the postrift phase and later compression, yielding the present thicker crust observed seismologically. The restriction of extension to a single normal fault in each rift segment, steeply inward-dipping rift shoulders with sharp hinges, and persistence of volcanism after rifting ended gave rise to a deep flood-basalt-filled rift geometry not observed in other presently-active or ancient rifts. The unusual coincidence of a rift and LIP yielded the world's largest deposit of native copper. This combination arose when a new rift associated with continental breakup interacted with a mantle plume or overrode anomalously hot or fertile upper mantle. Integration of diverse data types and models will give insight into important questions including how the magma source was related to the rifting, how their interaction operated over a long period of rapid plate motion, why the lithospheric mantle below the MCR differs only slightly from its surroundings, how and why extension, volcanism, and compression varied along the rift arms, and how successful seafloor spreading ended the rift phase.

Papers, talks, and educational material are available at
h*ttp://www.earth.northwestern.edu/people/seth/research/mcr.html*