A New View of the Plate-Tectonic Setting of the Mid-Continent Rift

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The Mid-Continent Rift (MCR) is often viewed as a failed rift formed by isolated midplate volcanism and extension within the ~1.3-~0.98 Ga Grenville orogeny. We propose instead that the rift was part of an evolving regional plate boundary system that resulted in a successful episode of seafloor spreading. This view is suggested by gravity data showing that the area between the rift arms acted as a microplate *(Merino et al., 2013).* Analogous behavior has been observed for younger and morphologically similar rift systems, whose plate tectonic settings are more easily understood because their surroundings - including seafloor with magnetic anomalies - have not been deformed or destroyed by subsequent collisions and rifting events. The new view has three significant advantages. First, MCR rifting looks like the block motion associated with the West Central African Rift systems formed during the Mesozoic breakup of Africa and South America and the ongoing rifting in the East African Rift region with seafloor spreading in the Gulf of Aden and the Red Sea. Second, this view explains why Grenville-age rocks in the Appalachians south of the New York Promontory have affinities to Amazonia rather than the Canadian Grenville-age Appalachian rocks. Third, if the MCR extends farther south than traditionally assumed, it may explain the rifting of Amazonia from Laurentia and its relative motion toward Greenland, coordinated with the opening of the MCR. The extensional phase on the MCR may have ended because the motion was taken up by seafloor spreading on other parts of the system. Later reverse faulting on the MCR normal faults due to compression, perhaps from collisions around Rodinia's margins, would not be unexpected because the MCR would be a relatively weak intraplate zone due to higher crustal temperatures and faults.

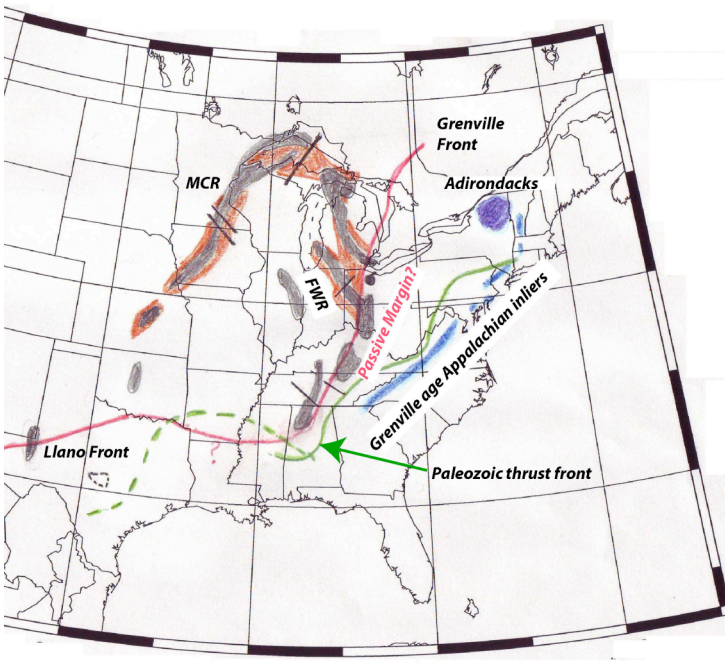

Plate tectonic setting proposed for the MCR. The ~105 Ma separating the youngest known MCR volcanism (~1.085 Ga) and the end of the Grenville orogeny dated in Canada (~0.98 Ga) is long enough for a Wilson cycle of ocean opening and closing. A passive margin may have formed eastward of and approximately parallel to some part of the possible continuation of the eastern arm south of Michigan. The rifted continental piece could have been reattached during the later Grenville collisions.