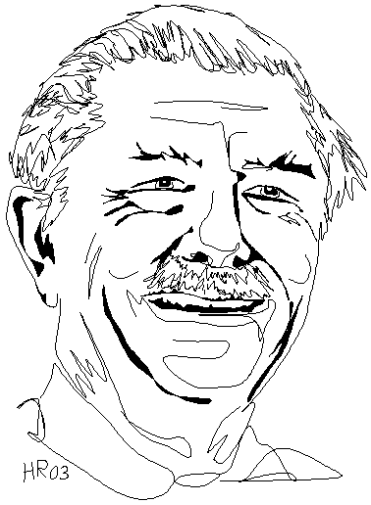
k19 The Mid-Continent Rift < sediments 1.0-1.2 Ga, basalts 1.17- 1.20 Ga >

> Sections and views are ... miniature representations of nature: and to them we look, perhaps, more than to memoirs, for a right understanding of an author's labours. —De la Beche.[1]

The Mid-Continent Rift (2000 km long and 100 km wide) beneath a covering platform sediments, is traceable, by magnetic and gravity geophysical surveys, through Iowa, southeast Nebraska, and western Kansas.[2] Its long-term subsidence, about 1.1 Ga, is recorded by a 15 km thick infill of redbed sediments (***Figure k19.1***) that grade from rudites at the fault margins, to river deposited crossbedded-sands and muds interiorly. Near their base, these sediments intertongue with Keweenawan age basaltic volcanic flows (Portage Lake Volcanics). These volcanics, together with intrusive volumes called the *Duluth gabbro*,[3] measure 7 km thick. This igneous activity occurred during an interval of 20 to 30 million years.

Native copper on the peninsula famously occurs as 1) lode deposits that came to fill former voids in conglomerates and the vesicular tops of lava flows and 2) fissure deposits that came to fill, sometimes large, voids in bed-transecting fracture zones. Ontario Indian extensive pit-mining of the fissure deposits (some contained great masses of metallic copper as much as hundreds of tons in weight) led pioneer geologists to most of the known deposits of this type.[4] However, wrote Norman King Huber in 1975, "such deposits, rich as they were, have been much less important than the lower grade but vastly larger lode deposits, which have produced about 98 percent of the total copper mined in the Native Copper district, about 5,400,000 tons."[5] More than 11 billion pounds of copper have been produced in the district over the 150 years of mining activity.[6]



An explanation for the origin of the copper by **Richard (Dick) Edwin Stoiber** (1911-2001)[7] and Edward Sheldon Davidson in 1959, since corroborated, is that metamorphism of the basalt at its base (to pumpellyite-epidote-prehnite-chlorite) released copper to hydrothermal water that circulated to precipitate it at low temperatures in near-surface open spaces.[8]

The Mid-Continent Rift in its eastern extension is at right angles to what was the Laurentian craton's southern margin (that is now within the Grenville Front). A plate-tectonics interpretation is that the Mid-Continent Rift is an aulacogen and the associated basaltic volcanism provides a record of when the southern margin of Laurentia-to-be came into being early in the Middle Proterozoic as unnamed oceans opened in fragmenting Rodinia. If so, the absence of Middle Proterozoic sediments along the southern margin of Laurentia requires explanation. ❑

Figure ***k19.1*** [9] Cross section of the Mid-Continent Rift geology (*see Figure k20.1*) looking southeast. The 'Keweenawan' fault is a young reverse-fault displacement on an ancient normal fault.