

k31 Great Lakes isotopic age provinces

< tectonic provinces, orogenic provinces >

Like a detective at a crime scene, the geologist relies on the evidence and knowledge of the operative processes to conclude what causes led to that evidence. The overall assemblage of evidence, and the explanatory surprises that it may generate ('consilience'), are used to suggest fruitful lines of inquiry. These tentative hypotheses are then subject to additional testing against new evidence. In other words, the geologist lets the planetary landforms tell their own 'story', just as the evidence at a crime scene reveals its story to an experienced detective. —Victor R. Baker.¹

I think it better to doubt until you know. Too many people assert and then let others doubt. —J. D. Dana's lecture witticism (while hardly a fall-down-laughing one) recalled by G. P. Merrill.²

The following truths became apparent from a comparison of ages obtained for mica minerals in basement gneisses in Michigan and Minnesota (**Figure k31.1**):

K-Ar and Rb-Sr radiometric ages of micas date the end of dynamic (fold) metamorphism and/or thermal metamorphism of a region. This is apparent in northern Michigan, where strata of the Animikie group *and* the nonconformity on which it rests are isoclinally folded by an orogeny called the *Penokean*. So there the underlying basement complex was refolded by the Penokean.

K-Ar and Rb-Sr radiometric ages of mica in the country rock are not regionally changed by dike intrusion or by faulting. This is apparent in Minnesota and southwestern Ontario from the radiometric ages obtained for the Duluth gabbro (crystallized 1.1 Ga) that intrudes, and is also down faulted, into the Animikie series strata that are tilted (but not folded) and the nonconformity on which they rest is now a homocline. So there the Animikie strata accumulated long after an orogeny called the *Algonian* folded the basement complex.³

In the basement complex, micas crystallized 1.1-1.7 Ga in the northern Michigan and 2.3-2.7 Ga in Minnesota and southwestern Ontario.⁴ These mica dates record when respectively the orogenies called the *Penokean* and the *Algonian* ended. □

Figure k31.1 Stratigraphic, structural and radiometric record of the Penokian and the Algonian orogenies (called in Canada the *Hudsonian* and the *Kenoran*, respectively). Early Proterozoic Animikie formations bury a profound nonconformity that truncates all older structures. In northern Michigan, Animikie strata and the nonconformity on which they rest are folded by the Penokian orogeny (radiometric dates are from *Aldrich et al*, 1960).⁵ In Minnesota and southwestern Ontario, Animikie strata are a homocline on the not-folded nonconformity that cuts across basement rocks folded by the Algonian orogeny (radiometric dates are from *Goldich, Nier, and Baadsgaard*, 1957).⁶

Cross section:

