

## The Lost Interval in the Michigan Basin

### I. Definition of “Lost Interval”

### II. The missing record

- Permian
- Triassic
- Early and Middle Jurassic
- Cretaceous
- Paleogene
- Most of the Neogene (Miocene/Pliocene)

### III. The rock record of the L.I.

- Late Jurassic redbeds (ss-sh-ls-gypsum)
  - Known only from subsurface
  - Age established from pollen (Cross’s work)

### IV. What was happening in Michigan during the LI?

Presumably some of the same things happening elsewhere in N. Am. At the time  
But there is no direct evidence in Michigan

### V. Evidence about the LI in Michigan

A. Observable/measurable features/phenomena in older rocks that modified those rocks after they formed

#### 1. Hydrothermal mineralization

- a) pyrite in Bellevue limestone (Mississippian)
- b) calcite and pyrite in Pa shales of Owosso and Corunna
- c) thus, timing is post-Carboniferous

#### 2. High maturity (thermal maturation) of Michigan Basin coal

MI Basin coal is highest grade of bituminous coal short of anthracite,

Implying:

#### a) a post-PA heat pulse

But there is no evidence of igneous rocks formed after the PA in MI  
(no drill core, gravity, or thermal modeling data)

-or-

#### b) a thick blanket of post-PA sediment (that the basin rocks were more deeply buried and hotter)

The Late Jurassic is deposited directly on PA sediments, so this material must have been gone by then

#### c) Timing of coal maturation

- i) cross-cutting relations
- ii) thermochronology
  - apatite fission track data

Ar-Ar dating: mica in middle Ord. St. Peter ss give that date, but illite in same rock gives younger date (Dev-Miss), implying reset of radiometric clock ~350 mybp, same time as Acadian Orogeny, suggesting that orogeny could explain heat source in Michigan Basin (Girard & Barnes)

#### d) Source of heat for coal maturation

- i) hydrothermal fluids migrated into MI?

Garven et al., 1993, regional orogeny-driven groundwater flow to explain mid-continent lead-zinc mineralization; applicable to MI?? (evidence: hydrothermal dolomitization along faults in MI basin; resetting of clocks in feldspars in basement rock)

*ii*) Problem: conodont color alteration index of specimens for Grand Ledge have undergone no color alteration, indicating no heating up (coal reflectance may differ from conodont alteration in ls). Was thermal event long enough to heat coal but too short to heat ls?

*iii*) Question: thermal maturity of Jurassic palynomorphs? Would help set timing of heating event.

B. Hard-to-find rock materials (that occur only locally or that formed under less-common circumstances). This evidence is from neighboring states; glacial deposits cover possible MI evidence. Strata preserved in:

- i. cryptoexplosion structures (e.g., Des Plaines disturbance, preserves Miss-Pa in NE Ill)
- ii. clasts in diatreme breccias—kimberlites in western UP contain frags of Ord ls.; example: Monteregian intrusives
- iii. small, fault-bounded basins (e.g., Plum River Fault Zone, IA)
- iv. paleocaves/paleokarst (e.g., Rock Island Co., IL)
- v. modern caves/karst (e.g., Pipe Creek Sinkhole, IN; Pliocene vertebrate fossils, the “first Tertiary continental biota discovered in the interior of the eastern half of N. Am.