

Detrital zircons from fluvial Jurassic strata of the Michigan basin: Implications for the transcontinental Jurassic paleoriver hypothesis: COMMENT

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Dickinson et al. (2010) call attention to an interesting problem in Michigan's geologic history, as well as that of North America during the Mesozoic. Their new detrital zircon age data represent a significant stepping stone toward the unraveling of provenance for the sedimentary rocks found as building stones in Ionia, Michigan. These "Jurassic" red beds of the Michigan basin have remained elusive enough for the Stratigraphic Lexicon of Michigan to call them "problematic" (Catacosinos et al., 2001). The Dickinson et al. paper is the first peer-reviewed publication about these rocks.

Despite the valuable zircon age dates, we fundamentally disagree with the fluvial and Jurassic interpretations, calling into question any interpretations for the "transcontinental Jurassic paleoriver hypothesis" as the title claims.

The Ionia formation is not recognized as a formal stratigraphic unit by the North American Commission on Stratigraphic Nomenclature (NACSN, 2005). To be recognized as a formation, there must first be a peer-reviewed publication that describes the basic sedimentology and stratigraphy of the rocks. No such publication exists for these rocks. Further, an application has to be made to the NACSN for the formal naming of a formation or any other stratigraphic unit (Jordan, 2009). It is inappropriate for this paper to have capitalized "formation," suggesting falsely that the NACSN has approved the name "Ionia Formation" (Owen, 2009).

In the title of this paper, the assumption is made that these rocks are fluvial. However, no description of the sedimentary textures (such as grain sizes, grain shapes, and grain surface features), sedimentary compositions, sedimentary structures (such as cross-bedding), fossils, or deposit geometry is given. Without such a description or citation of a peer-reviewed publication (or even abstract) that provides such data, the interpretation of depositional environment is not supported.

The study by Dickinson et al. employs a single sample of questionable origin. Traditionally, analytical agreement of at least three samples is considered necessary for viable interpretation of a rock's age.

The one rock analyzed is not in situ. It is from a building stone from the town of Ionia, but the location of the quarry from which it was taken is not specified. In order to make concrete interpretations, as has been done here, one must make certain the rock was not imported from elsewhere.

This study claims Jurassic age for the Ionia formation based upon pollen identification from Cross (1998b, 2001). There are problems with this: (1) Cross' abstracts about the Michigan red beds (Cross, 1975, 1986, 1998a, 1998b, 2001) are not peer-reviewed and do not give evidence for age or any detailed pollen data; (2) pollen data referred to was identified in detail by Shaffer (1968, 1969), yet Shaffer is not cited in this Dickinson et al. paper; (3) the "Jurassic" pollen analysis was of red shale core cuttings from ~100 km away from Ionia, and not from this "Ionia" sandstone; (4) the

Jurassic age was based upon the identification of *Classopollis* pollen, yet this age range may now be considered as wide as Triassic–Paleocene (The Paleobiology Database; <http://www.paleodb.org/cgi-bin/bridge.pl>); and (5) recent new data has shown Pennsylvanian age for an in situ shallow core sample of this "Ionia" sandstone and related red beds (Benison et al., 2009, Knapp et al., 2007). Dickinson et al. (2010) present robust and likely valid detrital zircon ages, the youngest of which is 382 Ma. Therefore, based on the data presented in the paper, the building stone, as dated, can be any age since the Devonian.

In conclusion, you can't get the big things right unless you first get the little things right.

We question the fundamental assumptions that the sample providing the zircons is fluvial and Jurassic. Therefore, we recommend the acceptable scientific resolution of this basic framework be made before any conclusions about the Jurassic paleoriver hypothesis may be assessed.

REFERENCES CITED

- Benison, K.C., Knapp, J.P., and Dannenhoffer, J.M., 2009, A new core of shallow red beds from the Michigan Basin [abs.]: American Association of Petroleum Geologists Annual Meeting, Denver, Colorado, AAPG Search and Discovery Article #90090.
- Catacosinos, P.A., Harrison, W.B., III, Reynolds, R.F., Westjohn, D.B., and Wollensak, M.S., 2001, Stratigraphic lexicon for Michigan: Lansing, Michigan, Michigan Basin Geological Society Bulletin 8, 56 p.
- Cross, A.T., 1975, Jurassic plants of the Michigan Basin: Albuquerque, New Mexico, Abstracts, American Association of Petroleum Geologists Annual Meeting, p. 14–15.
- Cross, A.T., 1986, Correlation of Jurassic palynofloras of the Michigan Basin with other Mesozoic floras of the eastern Mid-Continental United States: Program with Abstracts, American Association of Stratigraphic Palynologists Annual Meeting, New York, New York, p. 5.
- Cross, A.T., 1998a, The Jurassic terrestrial palynoflora of Michigan: Program with Abstracts, American Association of Stratigraphic Palynologists Annual Meeting, Ensenada, Baja California, Mexico.
- Cross, A.T., 1998b, The Ionia Formation: New designation for the mid-Jurassic age "red beds" of the Michigan Basin: Program with Abstracts, American Association of Petroleum Geologists Bulletin, v. 82, p. 1766.
- Cross, A.T., 2001, Mid-Jurassic Age "Red Beds" of the Michigan basin: Program with Abstracts: American Association of Petroleum Geologists Bulletin, v. 85, p. 1531.
- Dickinson, W.R., Gehrels, G.E., and Marzolf, J.E., 2010, Detrital zircons from fluvial Jurassic strata of the Michigan basin: Implications for the transcontinental Jurassic paleoriver hypothesis: *Geology*, v. 38, p. 499–502, doi:10.1130/G30509.1.
- Jordan, R.R., 2009, Layer by layer: An account of the North American Commission on Stratigraphic Nomenclature: *Stratigraphy*, v. 6, p. 170–182.
- Knapp, J.P., Benison, K.C., and Dannenhoffer, J.M., 2007, Revisiting the red bed problem in the Michigan Basin: More complicated than you'd think: *Geological Society of America Abstracts with Programs*, v. 39, no. 6, p. 152.
- North American Commission on Stratigraphic Nomenclature, 2005, North American Stratigraphic Code: The American Association of Petroleum Geologists Bulletin, v. 89, p. 1547–1591.
- Owen, D.E., 2009, How to use stratigraphic nomenclature in papers, illustrations, and talks: *Stratigraphy*, v. 6, p. 106–116.
- Shaffer, B.L., 1968, Palynology and geology of newly discovered Jurassic sediments in the Michigan Basin: Mexico City, Mexico, Geological Society of America Special Paper 115 (abs.), p. 376–377.
- Shaffer, B.L., 1969, Palynology of Michigan "red beds" [Ph.D. dissertation (unpublished)]: East Lansing, Michigan, Michigan State University, 261 p.