

## Shifts in Depocenter Locations during the Mississippian in the Michigan Basin (USA, Canada)

J.A. East<sup>1</sup> and C.S. Swezey<sup>1</sup>

<sup>1</sup>U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, VA 20192 jeast@usgs.gov

Very few comprehensive studies have been published on the structural geology of the Michigan Basin, which spans the USA-Canada border. One study by C.E. Prouty (1988) postulated that during the Mississippian Subperiod the primary depocenter of the Michigan Basin shifted approximately 30 miles west-southwest from the vicinity of Saginaw Bay towards the geographic center of the basin. This postulated shift in depocenter is coincident with an unconformity between the Osagian Marshall Sandstone and the overlying Meramecian Michigan Formation. Using modern international stratigraphic terminology, this unconformity is within the Middle Mississippian Visean Stage. Detailed GIS analysis of isopach maps suggests that the Kinderhookian Sunbury Shale is less than 30 ft thick throughout most of the basin, although thicknesses greater than 140 ft are present on the eastern side. The Sunbury Shale depocenter (point of greatest isopach thickness) is located in eastern Michigan at 43.38659 degrees latitude and -82.59214 degrees longitude. The Sunbury Shale is overlain by the Kinderhookian Coldwater Shale, which attains a maximum thickness of 1,300 ft. The Coldwater Shale depocenter is located at 43.30404 degrees latitude and -84.88010 degrees longitude. The Coldwater Shale is overlain by the Osagian Marshall Sandstone, which attains a maximum thickness of 350 ft. The Marshall Sandstone depocenter is located at 43.46626 degrees latitude and -84.33664 degrees longitude. The Marshall Sandstone is capped by an unconformity, above which lies the Meramecian Michigan Formation. The lower part of the Michigan Formation is a sandstone that is informally named the Michigan Stray sandstone, which ranges in thickness from 250 to 600 ft in the central part of the basin. The depocenter of the Michigan Stray sandstone is located in central Michigan at 43.99952 degrees latitude and -85.01863 degrees longitude. In summary, the Coldwater Shale depocenter is located approximately 110 miles west of the Sunbury Shale depocenter. The Marshall Sandstone depocenter is located approximately 30 miles east-northeast of the Coldwater Shale depocenter. The Michigan Stray sandstone depocenter is located approximately 110 miles northwest of the Marshall Sandstone depocenter. This westward shift from the Marshall Sandstone depocenter to the overlying Michigan Stray sandstone depocenter occurred just after or during the latter part of the Acadian Orogeny. Possible explanations for this depocenter shift include sediment loading and (or) tectonic processes associated with the Acadian Orogeny. However, the isopach maps do not reveal a unidirectional major shift in depocenter location from the Sunbury Shale to the Michigan Formation, suggesting that the unconformity beneath the Michigan Formation and the shift in depocenter location is more likely a result of sediment loading rather than tectonic processes.