

## **Reservoir potential of calcarenaceous sandstones in a carbonate and evaporitic tidal flat sequence: Silurian Tonoloway Formation, Highland County, Virginia**

John T. Haynes<sup>1</sup>, Sharon E. Porter<sup>1</sup>, Philip C. Lucas<sup>2</sup>, Richard A. Lambert<sup>3</sup>, Tim Rose<sup>4</sup>, Stephen A. Leslie<sup>1</sup>, and Steven J. Whitmeyer<sup>1</sup>

<sup>1</sup>James Madison University, Dept. of Geology & Environmental Science, Memorial Hall MSC 6903, Harrisonburg, VA 22807, [haynesjx@jmu.edu](mailto:haynesjx@jmu.edu), [lesliesa@jmu.edu](mailto:lesliesa@jmu.edu), [whitmesj@jmu.edu](mailto:whitmesj@jmu.edu), [porte2se@jmu.edu](mailto:porte2se@jmu.edu)

<sup>2</sup>Virginia Speleological Survey, Virginia Speleological Survey, 587 Limestone Lane, Burnsville, VA 24487, [lucas@virginiacaves.org](mailto:lucas@virginiacaves.org)

<sup>3</sup>Virginia Speleological Survey, P.O. Box 151, Monterey, VA 24456, [caves@htcnet.org](mailto:caves@htcnet.org)

<sup>4</sup>Smithsonian Institution, Department of Mineral Sciences, PO Box 37012, MRC 119, Washington, DC 20013-7012, [ROSET@si.edu](mailto:ROSET@si.edu)

Stratigraphic and petrographic study of 12 well exposed partial and complete sections of the Silurian (Cayugan) Tonoloway Formation show that it is a much more heterogeneous unit than previously reported. Up to seven (7) sandstones occur in the lower and upper members of the Tonoloway, and a breccia layer formed from dissolution and collapse of evaporites and subsequent partial replacement by calcite occurs in the upper member. The sandstones are quartz arenites, and several are calcarenaceous, with whole and fragmental echinoderms, bryozoans, and brachiopods present in varying abundance. Early cementation of these effectively prevented later porosity reduction by quartz overgrowths. Dissolution of this bioclastic debris has led to increased porosity and permeability in several of the sandstones.

Three of the sandstones outcrop along the northwest limb of the Wills Mountain anticline in the westernmost surface exposures of Silurian strata on the east side of the Appalachian basin. If these sandstones extend into the subsurface, as appears likely, they are potential hydrocarbon reservoirs in the subsurface Appalachian basin. Potential seals are evaporite tongues of the Salina Formation, the Tonoloway equivalent of the western Appalachian basin. In March 2010 we identified brecciated evaporitic sediment with pseudomorphs of gypsum rosettes and “chicken-wire” anhydrite textures in two separate outcrops of the upper member of the Tonoloway. Thus, there is stratigraphic overlap of potential reservoir facies and potential evaporite seals. Possible source rocks include black shales in the McKenzie and Tuscarora Formations in these same exposures along the northwest limb of the Wills Mountain anticline.